highways england

A66 NTP Integrated Project Team

A66 Northern Trans-Pennine

PCF Stage 3 Environmental Scoping Report

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1 Introduction

1.1 Purpose of this report

1.1.1 This Environmental Scoping Report (ESR) has been compiled to comprise an application for a Scoping Opinion from the Secretary of State, for the purposes of Regulation 10 of *The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the EIA Regulations)* (Legislation, 2017)[2].

1.1.2 The A66 Northern Trans-Pennine Project (hereinafter referred to as 'the project') is being progressed by Highways England supported by AmeyArup. The project is now in the Preliminary Design stage which comprises:

- Undertaking surveys (such as topographical, geotechnical and environmental).
- Community consultation including exhibitions, completing consultation reports and resolving outstanding issues where possible.
- Completing and freezing the preliminary design of the preferred route.
- Preparing the draft Development Consent Order (DCO) application.
- Completing the Environmental Impact Assessment (EIA) and preparing the Environmental Statement (ES), including undertaking the EIA scoping process.

1.1.3 Highways England intends to make an application for a DCO to the Planning Inspectorate (PINS) with the application currently planned for submission in early 2022. The application will be supported by a range of plans and documents, including an ES presenting the results of the EIA.

1.1.4 In line with the EIA Regulations, the purpose of this ESR is to:

- Provide a summary of the project and alternatives considered to date
- Set out the proposed scope of work and methods to be applied in carrying out the EIA
- Set out the proposed structure and coverage of the ES to be submitted with the DCO application.

1.1.5 The project will be undertaken in line with *Highways England: Licence* (Department for Transport, 2015a)[3] which outlines that Highways England has a duty to "*minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment*" and "*conform to the principles of sustainable development*".

1.1.6 In 2014, the Department for Transport (DfT) announced its five-year investment programme for making improvements to the Strategic Road Network (SRN) across England. The project is one of more than 100 schemes identified as part of the first *Road Investment Strategy (RIS1) 2015-2020* (Department for Transport, 2015b)[4]. Funding for delivery of the project has been confirmed within the second *Road Investment Strategy (RIS2)* (Department for Transport, 2020)[5], which covers the

[2] Legislation (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulation (as amended), available at: https://www.legislation.gov.uk/uksi/2017/572/pdfs/uksi_20170572_en.pdf
[3] Department for Transport (2015a) Highways England: Licence, available https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/431389/strategic-highways-licence.pdf
[4] Department for Transport (2015b), Road investment strategy: 2015 to 2020, available at: https://www.gov.uk/government/publications/road-investment-strategy-for-the-2015-to-2020-road-period
[5] Department for Transport (2020), Road investment strategy: 2020 to 2025, available at: https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to2025

period between 2020 and 2025 which was published in March 2020. The project is aligned with the principles set out in *RIS1* and *RIS2* which promotes improving the road network to support the economy, create a greener network, making a safer and more reliable network, a more integrated network and a smarter network. The project is also consistent with the overarching principles of the *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014a)[6].

1.1.7 The recommended preferred route was announced at the end of the Option Selection stage. This preferred route has been and continues to be the subject of ongoing design development and refinement. The preliminary design will be frozen following detailed surveys, assessment and consultation with statutory and non-statutory bodies and the public. The Preliminary Design stage is complete when the ES is produced and a DCO application is developed and submitted for the project, based on the preliminary design. Further details about the project are provided in Chapter 2: The Project.

1.1.8 The ES will document the baseline environmental conditions, present an assessment of the proposed route and outline mitigation measures required to mitigate potential environmental effects. Potential environmental opportunities will also be identified where appropriate. Any mitigation measures relied upon within the ES will be secured via the requirements of the DCO or planning obligation, as appropriate.

1.1.9 As the project is a Nationally Significant Infrastructure Project (NSIP) requiring a DCO, the ES will be prepared in accordance with *the EIA Regulations*. The *NPSNN* is applicable to this project as it provides planning guidance for promoters of NSIP on the road network. It is also the basis for the examination process by the Examining Authority for DCO applications, and the basis for decisions by the Secretary of State (SoS).

1.2 Overview of the project

1.2.1 The project comprises the improvement of the A66 between the M6 at Penrith and the A1(M) at Scotch Corner, as shown in Figure 1-1.

1.2.2 Between the M6 and the A1(M) the existing route is 80km in length. Along this length it is intermittently dualled, however, there is approximately 30km of single carriageway, within six separate sections, making the route accident-prone and unreliable.

1.2.3 The route carries high levels of freight traffic and is an important route for tourism and connectivity for nearby communities. The variable road standards, together with the lack of available diversionary routes when incidents occur, affects road safety, reliability, resilience and attractiveness of the route.

1.2.4 The project comprises upgrades to the existing single carriageway sections to dual carriageway, and is formed of a number of schemes. Some of these schemes involve online widening of the carriageway and some are offline (i.e. new sections of road that follow a different route but reconnect into the main A66 alignment). Along with dualling the six sections of single carriageway, other improvements will be made along the route, such as junction improvements at the M6 Junction 40 at Penrith, and minor improvements to the existing dual carriageway sections of the A66 within the existing highway boundary (for example new signs or road markings).

[6] Department for Transport (2014) National Policy Statement for National Networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

1.2.5 Once complete, the project will lead to the entire 80km route having two lanes in both directions. This will improve journey time, safety and connectivity.

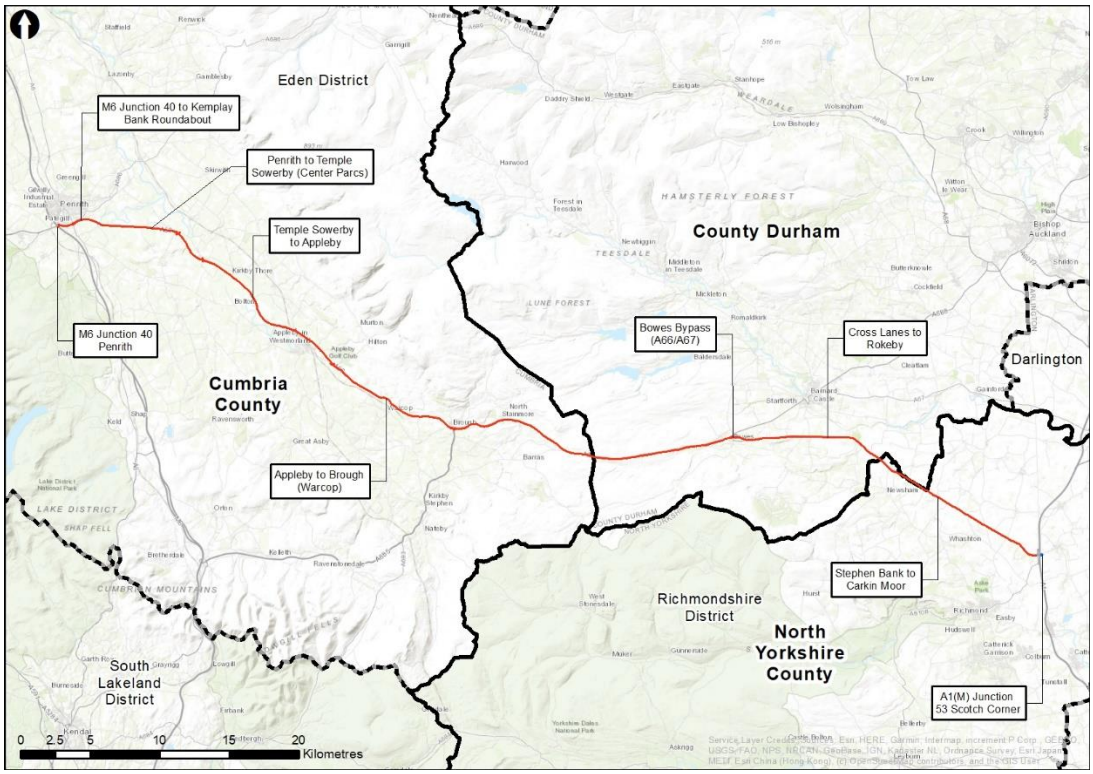


Figure 1-1: A66 Location and Overview of Scheme Locations

1.3 Project Speed

1.3.1 The A66 NTP now forms part of Government's 'Project Speed', which is aiming to bring forward proposals to deliver the UK Government's public investment projects more strategically and efficiently. This is aiming to ensure we are building the right things better and faster than previously, and specifically to *"cut down the time it takes to develop, design and deliver vital infrastructure projects "* (Government, 2020)[7].

1.3.2 The optimisation of the A66 NTP approach in line with Project Speed will have a number of implications for the EIA process. The key measures that are being implemented to aid optimisation of the delivery programme (and ultimately an earlier scheme completion date) include:

- Retention of flexibility in design at the DCO stage to allow buildability matters to influence the detailed design and the Environmental Management Plans (EMP) to be developed post-consent. This will also allow the detailed design to respond to all the EIA findings and issues emerging from examination without the need for lengthy reapproval processes or downstream consents. This work is to be undertaken in recognition that, if anything were to change materially from that included in the DCO and assessed in the ES, a formal change to the DCO would still be required.

[7] Government (2020) PM: A New Deal for Britain, available at: https://www.gov.uk/government/news/pm-a-new-deal-for-britain

- Where route alignments are fixed (see Chapter 2: The Project), traffic, noise and air quality modelling to inform the EIA may be undertaken earlier in the programme, based on appropriate parameters, to allow the EIA to fully influence the developing design.

1.3.3 This has a number of implications for how the EIA is approached:

- Surveys to inform the EIA are ongoing and will continue throughout 2021 and into early 2022. For certain locations and receptors, due to the timing of surveys, land access constraints and the optimised programme, full survey data may not be available at the time of the EIA. This will be very limited in area and extent, and the EIA will be based on all the survey data available, desk based data and a highly precautionary worst-case approach to ensure all significant effects are identified and reported in the ES. Survey data that become available as the DCO is submitted and early in the acceptance period will be submitted to verify the findings of the ES.
- Retention of flexibility (through limits of deviation) will mean impacts and mitigation could change between the initial EIA based on the 'reasonable worst case' limits of deviation reported in the Preliminary Environmental Information (PEI) Report, the indicative design to be submitted with the DCO application and assessed in the ES, and the final detailed design completed by the contractor after the DCO process is complete. This will require an approach where a realistic worst-case scenario is presented in the ES, limits of deviation and parameters specified in the DCO for the indicative design submitted to inform the DCO examination, and specific DCO requirements to ensure that the detailed design does not lead to different or greater environmental impacts than those assessed for the reasonable worst-case.
- Increased reliance on and importance of EMP to be adaptive to the development of the detailed design.

1.3.4 Initial, informal, consultation has been held with a number of stakeholders regarding this approach and how the EIA should be delivered, and the feedback received from this engagement has informed the approach and methods set out in this ESR. As the approach to optimisation is still evolving, ongoing close engagement with key statutory consultees and stakeholders is a core principle in the delivery approach for the project. Further information on consultation for the project is presented in Chapter 4: Consultation and discussion on the Evidence Plan process is included in Section 5.8 in Chapter 5: Environmental Assessment Methodology.

1.4 Content of the Environmental Scoping Report

1.4.1 The *EIA Regulations* set out the requirements for an applicant who proposes to request a scoping opinion from the Secretary of State. Regulation 10(3) of *the EIA Regulations* requires a scoping report to include:

a) A plan sufficient to identify the land.

b) A description of the proposed development, including its location and technical capacity.

c) An explanation of the likely significant effects of the development on the environment.

d) Such other information or representations as the person making the request may wish to provide or make.

1.4.2 The purpose of this ESR is therefore to:

a) Provide a summary of the proposed Scheme and alternatives considered to date.

b) Set out the proposed scope of work and methods to be applied in carrying out the EIA.

c) Set out the proposed structure and coverage of the ES to be submitted with the DCO application.

1.4.3 This ESR is set out in accordance with the standards set out in Design Manual for Roads and Bridges (DMRB) Volume 11, and guidance within *PINS Advice Note Seven (AN7)* (Planning Inspectorate, 2020)[8]. *AN7* idenfities the key information that should be provided with a scoping request. This is presented in Table 1-1 with a note of where the information can be found in this ESR.

Table 1-1: *AN7* Scoping Information Requirements

Information required	Location in ESR
The Proposed Development	
An explanation of the approach to addressing uncertainty where it remains in relation to elements of the Proposed Development e.g. design parameters.	Chapter 2: The Project and Chapter 5: Environmental Assessment Methodology
Referenced plans presented at an appropriate scale to convey clearly the information and all known features associated with the Proposed Development.	Chapter 18: Figures
EIA Approach and Topic Areas	
An outline of the reasonable alternatives considered and the reasons for selecting the preferred option.	Chapter 3: Alternatives
A summary table depicting each of the aspects and matters that are requested to be scoped out allowing for quick identification of issues.	Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects
A detailed description of the aspects and matters proposed to be scoped out of further assessment with justification provided. Results of desktop and baseline studies where available and where relevant to the decision to scope in or out aspects or matters.	Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects
Aspects and matters to be scoped in, the report should include details of the methods to be used to assess impacts and to determine significance of effect eg criteria for determining sensitivity and magnitude.	Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects
Any avoidance or mitigation measures proposed, how they may be secured and the anticipated residual effects.	Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects
Information Sources	

[8] Planning Inspectorate (2020) Advice Note Seven: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements, v7, available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/12/Advice-note-7.pdf

Information required	Location in ESR
References to any guidance and best practice to be relied upon.	Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects
Evidence of agreements reached with consultation bodies (for example the statutory nature conservation bodies or local authorities).	Chapter 4: Consultation and Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects
An outline of the structure of the proposed ES.	Chapter 5: Environmental Assessment Methodology

2 The Project

2.1 Need for the Project

2.1.1 The A66 Northern Trans-Pennine Project ('the project') is being progressed by Highways England supported by AmeyArup via a Design Partner and Technical Adviser contract. Options appraisal has been undertaken through a staged process (see Chapter 3: IntroductionAssessment of Alternatives) and a Preferred Route was announced in March 2020. The design is currently being developed, assumptions tested and validated, and environmental assessment being undertaken, and an application for a Development Consent Order (DCO) is being consulted on and prepared.

2.1.2 The existing A66 is a key national and regional strategic transport corridor and link for a range of travel movements. It carries high levels of freight traffic and is an important route for tourism and connectivity for nearby communities. There are no direct rail alternatives for passenger or freight movements along the corridor.

2.1.3 Despite the strategic importance of the A66, the route between the M6 at Penrith and the A1(M) at Scotch Corner is only intermittently dualled and has six separate sections of single carriageway. The route also carries local slow moving agricultural and other traffic making short journeys, which can have an impact on other users, especially on the single carriageway sections. The variable road standards, together with the lack of available diversionary routes when incidents occur, affects road safety, reliability, resilience and attractiveness of the route.

2.1.4 If the existing A66 route is not improved, it will constrain national and regional connectivity and may threaten the transformational growth envisaged by the Northern Powerhouse initiative and the achievement of the Government levelling up agenda.

2.1.5 The A66 is the most direct route between the Tees Valley, north, south and west Yorkshire, the East Midlands, eastern England, north Cumbria, and the central belt of Scotland and Cairnryan (for access to Ireland). The recent improvements to bring the A1(M) carriageway to motorway standards between Leeming Bar and the A66 (M) is also expected to increase the attractiveness of south-to-north movements along the A66.

2.1.6 The need for improvements to the A66 corridor was identified in the Northern Trans-Pennine Routes (NTPR) *Strategic Study announced as part of the first Road Investment Strategy (RIS1*) in December 2014 (Department for Transport, 2015a)[9]. The study was one of six national strategic studies. Funding for the A66 corridor improvements was committed to in the *Road Investment Strategy 2 (RIS2)* in March 2020 (Department for Transport, 2020)[10].

2.1.7 Subsequently to the Preferred Route Announcement it was determined that works are also required to the junctions with the M6 at Penrith (J40) and the A1(M) at Scotch Corner, in order to ensure the entire route achieves consistent standards and meets the Project Objectives.

[9] Department for Transport (2015a), Road investment strategy: 2015 to 2020, Accessed January 2020, https://www.gov.uk/government/publications/road-investment-strategy-for-the-2015-to-2020-road-period

[10] Department for Transport (2020), Road investment strategy: 2020 to 2025, Accessed March 2020, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/951100/road-investment-strategy-2-2020-2025.pdf

2.2 Project Objectives

2.2.1 Highways England has been appointed by the Secretary of State (SoS) to be the highway authority, traffic authority and street authority for the *Strategic Road Network Initial Report (SRN)* (Highways England, 2017)[11] and pursuant to the Infrastructure Act 2015. As such Highways England has set the objectives for the project which are presented by Theme in Table 2-1.

Table 2-1: A66 Project Objectives

Theme	Project Objectives
Economic	Regional: Support the economic growth objectives of the Northern Powerhouse and Government levelling up agenda.
	Ensure the improvement and long-term development of the SRN through providing better national connectivity including freight.
	Maintain and improve access for tourism served by the A66.
	Seek to improve access to services and jobs for local road users and the local community.
Transport	Improve road safety, during construction, operation and maintenance for all, including road users, Non-Motorised Users (NMU), road workers, local businesses and local residents.
	Improve journey time reliability for road users.
	Improve and promote the A66 as a strategic connection for all traffic
	Improve the resilience of the route to the impact of events such as incidents, roadworks and severe weather events.
	Seek to improve NMU provision along the route.
Community	Reduce the impact of the route on severance for local communities.
Environment	Minimise adverse impacts on the environment and where possible optimise environmental improvement opportunities.

2.2.2 Part 4 Aims and Objectives of *Highways England: Licence* (Department for Transport, 2015b)[12] states that Highways England has a duty to *"minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment"* and *"conform to the principles of sustainable development".*

2.3 Project Location

2.3.1 The A66 lies within three local planning authority administrative areas: Eden District, Durham County and Richmondshire District as illustrated in Figure 1-1 in Chapter 1: Introduction.

2.3.2 The A66 runs through the North Pennines Area of Outstanding Natural Beauty (AONB) between Brough and Bowes. The Lake District National Park is

[11] Highways England (2017) Strategic Road Network Initial Report, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/666884/Highways_England_Strategic_Road_Network_Initial_Report_-_WEB.pdf

[12] Transport for Transport (2015b) Highways England: Licence, Accessed January 2020, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/431389/strategic-highways-licence.pdf

approximately 2km south-west of Penrith and the Yorkshire Dales National Park is located approximately 3.5km south of the A66.

2.3.3 The A66 lies within an area of rolling landscape. From Penrith the road corridor generally passes through gentle valleys characterised by large regular fields and areas of deciduous woodland. The road generally follows a similar route to the River Eden as far as Appleby-in-Westmorland. Moving east the elevation rises rapidly from approximately 170 metres (m) above ordnance datum (AOD) at Brough to a high point of approximately 440m AOD as it passes over Bowes Moor before gradually descending again to an elevation of approximately 150m AOD at Scotch Corner.

2.3.4 The highway roughly follows the line of a Roman road and as a result is straight in alignment for large sections, but, with notable deviations as it passes around key settlements along the route, including, Penrith, Temple Sowerby, Kirkby Thore, Appleby- In-Westmorland, Brough, Bowes, Greta Bridge and Scotch Corner.

2.3.5 The majority of the surrounding land is agricultural with a number of farms lying adjacent and having direct accesses onto the A66. Some of this land is classified as being Grade 2 which is defined as ‘very good’ agricultural land.

2.3.6 There are a number of historic constraints along the route including conservation areas, Scheduled Monuments and a large number of Grade I, II* and II listed buildings many of which lie directly adjacent to the A66. These are presented on Figures 9.1-9.2 in Chapter 18: Figures.

2.3.7 The North Pennine Moors Special Protection Area (SPA) and Special Area of Conservation (SAC) are encompassed within the North Pennines AONB. The River Eden SAC and its tributaries which run adjacent to and underneath the A66 are also a key consideration. These sites are all important at European level and are presented in Figure 7.1 in Chapter 18: Figures.

2.3.8 The River Eden (designated a main river) crosses the A66 at Coupland Viaduct and 3km south-east of Appleby-In-Westmorland. Flood Zones 2 and 3 associated with the River Eden, its tributaries and other watercourses are located along the route presented in Figure 15.1 in Chapter 18: Figures.

2.4 Project Overview

2.4.1 The project includes upgrading the existing single lane sections of the A66 to dual two-lane all-purpose roads with a speed limit of 70mph. The project also includes amendments to existing junctions and accesses within these sections.

2.4.2 The project has been split into a number of schemes (refer to Figure 1-1 in Chapter 1: Introduction). Detailed information on the individual scheme components, so far as design development has progressed at this stage (e.g. such as road section lengths, design specification, temporary and permanent above ground structures), are described in Section 2.5.

2.4.3 In addition to the ongoing design development of the scheme, as a result of further ongoing work to understand the baseline environment and further development of the design of the Preferred Route and the terminal junctions as well as ongoing consideration and regard to consultation and engagement responses and information, it was considered appropriate to undertake some additional detailed appraisal of alternative alignment routes at this stage for a number of the schemes (see Chapter 3: Assessment of Alternatives). Where alternatives are under consideration for a scheme, a precautionary approach has been taken to defining the study area for each environmental topic by adjusting it to account for the widest

geographical limits of alternatives still under consideration. Chapter 3: Assessment of Alternatives summarises the process of selecting the proposed route or the remaining alternatives being considered for each scheme.

2.4.4 Figure 2-1 in Chapter 18: Figures presents the current indicative DCO boundary. This has been developed for scoping purposes and is subject to further design and assessment work as the DCO application is progressed. The indicative DCO boundary has been derived using the latest design for each scheme. For those schemes where a single route alignment is being developed, the indicative DCO boundary includes land that would be required for the scheme and an allowance of land for mitigation based on the current stage of assessment. It should be noted this is subject to change, and ecological or other mitigation may be required outside this boundary. For those schemes where alternative route alignments or alternative junction arrangements are being considered, however, the design is not sufficiently developed to determine an indicative DCO boundary. A 250m buffer has been applied to the centre line of each of the alternative route alignments to derive an indicative DCO boundary for these schemes. This buffer has been amended only where it intersects with substantial settlements to remove the more densely populated areas from the boundary, however where properties remain within the buffer this should not be taken to mean those properties would definitely be affected by any of the alternative alignment routes or junction arrangements being considered for the project. It is expected that the final DCO boundary will largely be located within this 250m buffer once finalised for these schemes, although there is potential for mitigation or minor works to be required outside of it.

2.4.5 Typically, each carriageway would comprise two standard 3.65m wide lanes in each direction, 1m hardstrips and a central reserve. A minimum verge width of 2.5m would be provided, which would be increased as required to provide adequate visibility splays, highway drainage, communication ducts and street furniture. Where sections of the existing route are to be replaced on a new alignment, the intention is that the replaced section of road ceases to be a part of the trunk road network.

2.4.6 Details are not yet confirmed as to any other development that may take place associated with the project, such as off-route works, utilities diversions, etc. If any such works are required, these will be fully described in the Environmental Statement (ES) and assessed in terms of their potential significant environmental effects.

2.4.7 Figure 2-1 also includes the illustrative centrelines of each scheme and any alternative alignment routes still under consideration. The remainder of this chapter describes the key components of each scheme and, where applicable, any alternative alignment routes that are still under consideration at the time of writing.

2.5 Project Description (Scheme-by-Scheme)

M6 Junction 40 Penrith

2.5.1 See Figure 2-1 (Sheet 1 of 7). This scheme would provide a three-lane circulatory carriageway with spiral markings on the current roundabout. The A66 eastern arm of the roundabout would be widened to three lanes in each direction between M6 Junction 40 and Kemplay Bank Roundabout. Widening would be required on the following five approach arms to provide additional lanes and a dedicated left turn facility, each controlled under its own signal phase: M6 North, M6 South, A66 East, A66 West, and A592 Ullswater Road.

2.5.2 All existing local and depot accesses would be accommodated. This scheme would also include controlled crossings serving the existing shared cycle/footway connection on the western side.

2.5.3 All existing pedestrian and cycle connections would be retained on the Penrith South Bridge western side alongside Skirsgill Business Park. This would also be the case for the Skirsgill North-West pedestrian and cycle connections. The existing cycle/pedestrian route to Skirsgill Depot would be directed through a controlled crossing at the roundabout, due to safety considerations with the existing uncontrolled crossing which would be exacerbated by the widening of the A66 Eastern Arm to three lanes.

2.5.4 The existing police platform located on the Penrith North Bridge to the eastern side, between the M6 off slip and A592, would be retained in its current location. The existing police platform on the Penrith South Bridge western side would be relocated further into the widened verge to allow for the new dedicated left-hand lane from the M6 off slip.

M6 Junction 40 to Kemplay Bank Roundabout

2.5.5 See Figure 2-1 (Sheet 1 of 7). This scheme would provide an underpass through the existing Kemplay Bank Roundabout, allowing free-flowing traffic east-west and improving access to Penrith and the A6. This scheme would include new on-slip and off-slip roads with the A6 and A686 allowing users to safely join and leave the A66 in both directions, serving the local road network with links to Penrith, Eamont Bridge and other local settlements.

2.5.6 Signalisation of the roundabout would be retained to facilitate safe crossing at all five arms. Cycleways and footways currently located through the centre of the roundabout would be re-routed around the roundabout. The existing exit from the fire station linked with the existing traffic signals would be maintained throughout construction and remain in place once the works are complete.

2.5.7 Access would be provided into and out of the Cumbria Fire and Rescue Service fire station. This would also provide access to the Cumbria Police Constabulary. A number of access solutions are currently being explored as part of design development and these are being discussed with Cumbria County Council and Cumbria Police Constabulary.

2.5.8 This scheme would follow the existing road alignment. In cutting sections of the route, earthwork slopes are generally at 1:3 gradient (1:2.5 at the centre of the underpass). The maximum cutting would be approximately 8.5m deep at the southern verge of the underpass while the maximum fill embankment would be approximately 12m high along the southern verge.

2.5.9 A replacement layby would be provided on the eastbound carriageway. The existing layby on the westbound carriageway between Kemplay Bank Roundabout and M6 Junction 40 would be removed and would not be replaced.

Penrith to Temple Sowerby (Center Parcs)

2.5.10 See Figure 2-1 (Sheet 1 of 7). This scheme would provide full dualling of the existing A66 single carriageway section between Penrith and Temple Sowerby. The scheme would predominantly involve online widening using the existing carriageway to form one side of the new dual carriageway. The second carriageway would be constructed to the north of the existing carriageway.

2.5.11 A major grade-separated junction would be constructed at Center Parcs to connect this facility with the new alignment of the A66. This would provide access to Center Parcs and the local road network. The junction would cater for all movements on and off the A66, making it easier and safer for users to join the main highway and preventing tail backs at peak times.

2.5.12 A new left-in/left-out junction would be introduced to the B6262 to facilitate safe access to the local road network. Another new left-in/left-out junction would facilitate access to St Ninian's Church on Winderwath Estate. New left-in/left out junctions would be provided with associated acceleration and deceleration lanes to enable safe access to homes and businesses.

2.5.13 The short cycleway located east of Winderwath Farm would be diverted via the local road network to the Center Parcs Junction, where a shared cycleway/footway would be provided at the new bridge structure to enable the A66 to be crossed safely.

2.5.14 An existing access serving Whinfell Holme Wastewater Treatment Works would be converted to left-in/left-out. Design solutions to relocate this access are limited as the site is bounded on three sides by the River Eamont.

2.5.15 As a result of works to widen the carriageway the Llama Karma Kafe hospitality business is likely to lose a significant number of parking spaces. Various design solutions are under consideration for this location.

Temple Sowerby to Appleby

2.5.16 See Figure 2-1 (Sheet 2 of 7). Temple Sowerby to Appleby is one of the schemes where further consideration of alternative alignment routes is ongoing, in order to minimise the potential impact on the River Eden SAC (where the route included in the Preferred Route Announcement crosses Trout Beck, one of the tributaries of the River Eden included within the SAC). The following section describes the alternative alignment routes currently under consideration.

2.5.17 The Preferred Route Announcement alignment is no longer under consideration and is therefore not described below. The evolution of it – the blue route – would affect a reduced length of floodplain and require shorter crossing of Trout Beck.

Blue Route (Evolved Preferred Route)

2.5.18 The blue route is an evolved version of the route that was included in the Preferred Route Announcement and would comprise a new offline bypass around the north of Kirkby Thore, a new bypass to the north of Crackenthorpe, and a number of new junctions and improvements.

2.5.19 Design evolution since the Preferred Route Announcement has not altered the proposed route from the western end of the village to the junction at British Gypsum. As the route travels south-east the alignment has moved approximately 100m east. Moving the route alignment reduces the length of affected floodplain at the Trout Beck crossing from 850m to around 400m. This alignment route would cross Trout Beck at a more perpendicular angle than the route indicated at the Preferred Route Announcement, with a shorter overall length of structure required and reduced potential for shading.

2.5.20 Temple Sowerby Bypass Junction would provide connections between the existing A66 and the local road network. A short section of road would connect from Temple Sowerby Bypass junction to the existing A66, allowing access for local traffic and other road users from Temple Sowerby to Crackenthorpe and beyond.

2.5.21 A new junction would be provided at Main Street to the north-east of Kirkby Thore. Main Street would pass over the proposed A66 alignment on a bridge structure. This junction would maintain the key local connection onto the A66 and also provide access to the British Gypsum plant via a private access road. This would contribute to a reduction in the number of HGV movements through Kirkby Thore.

2.5.22 New merge and diverge lanes would enable users to safely join and leave the A66 in both directions. New bridge structures for both Station Road and Sleastonhowe Lane would enable access over the A66. A diversion would lead from Priest Lane to Station Road to maintain local traffic access.

2.5.23 A new multi-span viaduct would be provided for the crossing over Trout Beck and its associated flood plain. The design of this viaduct would be informed by design review, flood modelling and the Habitats Regulations Assessment, which is ongoing.

2.5.24 A new junction at Long Marton to the south-east of Kirkby Thore would provide access to both the eastbound and westbound carriageways of the new A66 alignment. The junction would link to the previous A66 alignment and an existing minor road to provide access to both Bolton and Long Marton. New merge and diverge lanes would allow users to safely join and leave the A66.

2.5.25 At Crackenthorpe a new junction on the westbound carriageway of the new A66 alignment would provide left-in/left-out access. The junction would link to the previous A66 alignment and the B6542 and provide access to both Crackenthorpe and Appleby. New merge and diverge lanes would enable users to safely join and leave the A66.

2.5.26 Provision of an additional left-in junction to the eastbound carriageway at the existing Appleby bypass junction would make better use of the existing infrastructure. This, together with the proposed Crackenthorpe junction, would provide all movement access to the A66 west of Appleby.

Orange Route (Online Alternative Route)

2.5.27 The orange route falls slightly to the south of the existing A66 and would follow a similar alignment of the existing A66 through Kirkby Thore. The existing A66 would remain and be used as a local route. This route would cross Trout Beck at Bridge End, where the crossing is already constrained by the existing A66 bridge and the built environment around Kirkby Thore. A new bridge would be required for the A66, with the existing crossing being retained as a local access route. The route would re-join the alignment of the route included in the Preferred Route Announcement at the Long Marton junction and then continue to the north of Crackenthorpe.

2.5.28 A new junction west of Kirkby Thore would be provided and would link local traffic up to Priest Lane. The access would also allow access to the British Gypsum plant which involves following Priest Lane, Cross Street and Main Street and enables the Heavy Goods Vehicles (HGVs) to avoid having to travel through the centre of Kirkby Thore. New merge and diverge lanes would enable users to safely join and leave the A66.

2.5.29 This junction together with a diversion of the old A66 east of the village would provide east to west connectivity between the villages of Temple Sowerby and Appleby.

2.5.30 This route is shorter overall than the blue route.

Red Route (Offline Alternative Route)

2.5.31 The red route remains the same as the route included in the Preferred Route Announcement from the western end of the village and up to Sleastonhowe Lane. This route would then travel further to the east and would cross Trout Beck at one of

its narrowest points. It is estimated the crossing over Trout Beck would be approximately 250m at this location. An additional watercourse crossing of Keld Syke would also be required (not included within the River Eden SAC designation but is a tributary that flows into it).

2.5.32 This route would be much longer potentially resulting in impacts to a larger number of landowners. However it would be further from the village, and accesses to businesses north of Kirkby Thore would be maintained. This route from Sleastonhowe Lane would be designed to follow the natural landscape as far as practicable.

2.5.33 This route would move closer to the village of Long Marton and a junction would be provided along this stretch of the route. The location and design of this junction is still evolving. This route would re-join the route as included in the Preferred Route Announcement to the north of Crackenthorpe.

Appleby to Brough (Warcop)

2.5.34 See Figure 2-1 (Sheet 3 of 7). Appleby to Brough is one of the schemes where further consideration of alternative alignment routes is ongoing, in response to stakeholder feedback and to consider further minimising the potential impact on the North Pennines AONB located to the north of the existing A66. The following section describes the alternative alignment routes currently under consideration.

Black Route (included in Preferred Route Announcement)

2.5.35 The black route comprises upgrading a 7.8km section of carriageway from single to dual carriageway between Coupland Beck and Brough. The dualled section would require junction improvements to enable access on and off the A66 to improve user safety and reduce congestion.

2.5.36 Access for Café 66, local farms and agricultural land would be provided off the eastbound carriageway with a replacement agricultural and PRoW underpass linking to a new access on the westbound A66 for farms and agricultural land access only.

2.5.37 A new junction would provide a link to the B6259 to Sandford/Warcop as well as providing links for PRoW. A new underpass for access to agricultural land on the south side of the new A66 and for footpath connectivity would be provided adjacent to Wheatsheaf Farm. A new underpass for footpath connectivity would be provided east of Moor Beck.

2.5.38 A new junction is also proposed at Warcop on the westbound and eastbound carriageways facilitating access to the A66 in both directions and providing access to the village of Warcop and the de-trunked A66. This ensures access is maintained to the Ministry of Defence (MoD) Warcop Training Centre, side roads, properties and land to the north of the A66. The proposed left-in/left-left out priority junctions would be approximately 1.1km apart, designed to utilise existing side road connections, minimise earthworks and reduce environmental impacts.

2.5.39 A further junction is proposed at Langrigg near its current location. Movements would be limited by providing a left-only T-junction with appropriate diverge and merge tapers on the westbound carriageway only. A new local road to the south of the new A66 alignment would link with the village of Flitholme, providing access to the westbound A66 and the local road network.

2.5.40 Another local road would be provided to the south of the new A66 from Langrigg Lane to the west to link with a new overbridge, connecting to the existing A66 near Turks Head. This would provide access via the local road network west to Warcop or east

towards Brough via a new local road that connects the existing A66 route into Brough avoiding the new A66 route

2.5.41 A new farm accommodation and an overbridge for walkers, cyclists and horse-riders would be provided at the eastern end of the scheme near West View Farm, providing access to land on the north side of the A66 as well as footpath and bridleway connectivity. Local access that is provided to the north of the A66 for both the farm, walkers, cyclists, horse-riders and road users does fall within the Area of Outstanding Natural Beauty (AONB)

2.5.42 The de-trunked sections of the A66 would enable use by walkers, cyclists and horse-riders to maintain access into the AONB.

Alternative Alignment Routes

2.5.43 The black route was designed to remain outside the AONB as much as possible, however through design development it has become apparent that the eastern tie-in cannot be constructed, and local access cannot be maintained, without construction within the AONB. The setting impact on the AONB of a new route to the south of the existing A66 has also been considered further at this stage. This work has led to a review of the route alignment to determine whether there are alternatives that either remain completely outside the AONB, thus avoiding any direct impact, or that could minimise impact on the setting impact on the AONB as a result of the scheme.

2.5.44 A number of alternative alignment routes to the black route are now undergoing further detailed consideration for this scheme. To aid description of these alternatives, this scheme has been divided into three sections – western, central and eastern – as follows:

- Western section – from the western most extents of this scheme and for the first 3km there would be no deviation from the black route described above.
- Central section – in the central section there are three possible routes: black, blue and green.
- Eastern section – in the eastern section there are two possible routes: black and orange.

2.5.45 At this stage in the project, it is possible that the route eventually selected for this scheme could comprise any combination of the alternatives described in each section. There are therefore six possible route variations under consideration:

- Black + black + black (Preferred Route Announcement)
- Black + blue + black (deviate from Preferred Route Announcement in the central section only)
- Black + green + black (deviate from Preferred Route Announcement in the central section only)
- Black + black + orange (deviate from Preferred Route Announcement in the eastern section only)
- Black + blue + orange (deviate from Preferred Route Announcement in the central and eastern section)
- Black + green + orange (deviate from Preferred Route Announcement in the central and eastern section)

Western Section

2.5.46 The western section would comprise of 3km of online widening with a new westbound carriageway to the south of the existing carriageway, as described above. The remainder of the western section would be formed of a new dual carriageway to the south of the existing A66 alignment.

Central Section

Black Route (route included within the Preferred Route Announcement)

2.5.47 At Wheatsheaf Farm this route would continue to follow an alignment to the south of the existing A66 on an embankment passing through the MoD playing field and passing close to East Field Farm.

2.5.48 New junctions would be provided at Warcop on the westbound and eastbound carriageways facilitating access to the A66 in both directions and providing access to the village of Warcop and the de-trunked A66. These junctions would maintain access to the village of Warcop, the MoD facility, side roads, properties and land to the north and south of the A66 via a new underbridge located to the east of Moor Beck bridge. This section of the scheme runs on embankment.

2.5.49 The proposed left-in/left-left out priority junctions would be approximately 1.1km apart and designed to utilise existing side road connections and minimise earthworks.

2.5.50 A new underpass to retain footpath connectivity would be provided close to where the culvert crosses under the A66.

Blue Route

2.5.51 From Wheatsheaf Farm the blue route would shift approximately 50m to the south then follow an alignment utilising the existing A66 as the eastbound carriageway and a new westbound carriageway would be constructed directly to the south of the existing A66 alignment. This would require the purchase of MoD land but would result in reduced land take (compared to the black route) affecting East Field Farm.

2.5.52 The blue route would be at a similar grade to the existing A66, therefore reducing the amount of earthworks required and the visual impact (and potentially setting impact on the AONB) of the scheme as the embankments would be considerably lower in this location compared to black route.

2.5.53 A new local road would be provided to the north of the new A66 dual carriageway encroaching up to 150m into the AONB, avoiding direct impacts on residential properties and an MoD compound. Access needs to be maintained to a second MoD compound, in order to avoid the need for a replacement that would be within the AONB.

2.5.54 New junctions would be provided at Warcop on the westbound and eastbound carriageways facilitating access to the A66 in both directions and providing access to the village of Warcop and the de-trunked A66. These junctions would maintain access to the village of Warcop, the MoD facility, side roads, properties and land to the north and south of the A66 via a new overbridge located to the east of Moor Beck bridge.

2.5.55 The proposed left-in/left-left out priority junctions would be approximately 0.6km apart and designed to utilise existing side road connections and minimise earthworks.

2.5.56 A new footbridge to retain connectivity would be provided to the east of Walk Mill Barn.

Green Route

2.5.57 From Wheatsheaf Farm the green route would shift approximately 50m to the south then follow an alignment utilising the existing A66 as the eastbound carriageway and a new westbound carriageway would be constructed directly to the south of the existing A66 alignment. This would pass through MoD land and result in a reduced land take affecting East Field Farm compared to the black route.

2.5.58 The green route would be constructed on embankment, similar to the blue route, but would retain the road largely within the existing corridor.

2.5.59 A new local road would be provided to the north of the new A66 encroaching up to 100m into the AONB, avoiding direct impacts on residential properties and an MoD compound. This route would require the removal of a second MoD compound with a replacement likely to be within the AONB boundary.

2.5.60 New junctions would be provided at Warcop on the westbound and eastbound carriageways facilitating access to the A66 in both directions and providing access to the village of Warcop and the de-trunked A66. These junctions would maintain access to the village of Warcop, the MoD facility, side roads, properties and land to the north and south of the A66 via a new underbridge located to the east of Moor Beck bridge.

2.5.61 The proposed left-in/left-left out priority junctions would be approximately 0.6km apart and designed to utilise existing side road connections and minimise earthworks.

2.5.62 A new underpass to retain footpath connectivity would be provided to the east of Walk Mill Barn.

Eastern Section

Black Route (route included within the Preferred Route Announcement)

2.5.63 From East Field Farm the black route would follow an alignment to the south of the existing A66.

2.5.64 A junction would be provided at Langrigg close to its current location. Movements would be limited by providing a left-only T-junction with appropriate diverge and merge tapers on the westbound carriageway only.

2.5.65 A new local road to the south of the new A66 alignment would link with the village of Flitholme, providing access to the westbound A66 and the local road network.

2.5.66 A new local road would be provided to the south of the new A66 from Langrigg Lane heading east linking with a new overbridge at The Gatehouse, connecting to the existing A66 near Turks Head.

2.5.67 To the north of the A66 access would be provided to the local road network west to Warcop or east towards Brough. This would encroach into the AONB.

2.5.68 A new farm accommodation and overbridge for walkers, cyclists and horse riders (WCHR) would be provided at the eastern end of the scheme near West View Farm, providing access to land on the north side of the A66 and maintaining footpath and bridleway connectivity. This would encroach into the AONB.

2.5.69 De-trunked sections of the existing A66 would maintain access into the AONB for WCHR.

Orange Route

2.5.70 From East Field Farm the orange route would follow an alignment to the south of the existing A66.

2.5.71 A junction would be provided at Langrigg close to its current location. Movements would be limited by providing a left-only T-junction with appropriate diverge and merge tapers on the westbound carriageway only.

2.5.72 A new local road to the south of the new A66 alignment would link with the village of Flitholme, providing access to the westbound A66 and the local road network.

2.5.73 A new local road would be provided to the south of the new A66 from Langrigg Lane to the west linking with a new overbridge at The Gatehouse, connecting to the existing A66 near Turks Head.

2.5.74 To the north of the A66 access would be provided to the local road network west to Warcop or east towards Brough. This would encroach into the AONB.

2.5.75 The new A66 would take a route to the south of West View Farm and residential properties. The property at Mains House would require to be demolished.

2.5.76 This route would tie back into the existing A66 at Musgrave Lane Overbridge and would avoid any encroachment into the AONB but would require a new watercourse crossing at Low Gill Beck.

2.5.77 A new farm accommodation underpass would be required to provide access to land on south side of the new A66, and to maintain footpath and bridleway connectivity.

2.5.78 De-trunked sections of the existing A66 would maintain access into the AONB for WCHR.

Bowes Bypass (A66/A67)

2.5.79 See Figure 2-1 (Sheet 4 of 7). Bowes Bypass is one of the schemes where further consideration of alternative alignment routes is ongoing, though to a lesser extent than the schemes described previously. Design development of this route has highlighted that construction is required within the North Pennines AONB at the Western extent to tie the route back into the existing A66. A second alternative alignment route is under consideration to minimise this potential impact.

Black Route (route included within the Preferred Route Announcement)

2.5.80 The black route would closely follow the existing road alignment to the north of the village of Bowes, with a new adjacent eastbound carriageway to the north. The existing carriageway would be changed to carry westbound traffic. The new carriageway would begin east of Clint Lane Overbridge running to the eastern scheme extents.

2.5.81 At the junction with the A67, an underbridge would carry the new eastbound carriageway. Two new slip roads would accommodate traffic travelling to and from the east. These would provide access to and from the A67 and Bowes. Some derelict buildings at the junction and a barn structure would require to be demolished.

2.5.82 Access from Bowes to the A66 (via the Roman road known as The Street, and locally known as Low Road) would be stopped up. The upgraded grade separated Bowes Junction would provide safer access to the A66 for local traffic.

Blue Route (Northern Alternative Route)

2.5.83 The blue route would be identical to the black route described above, other than that the alignment of the road would move slightly north to fall outside the boundary of the AONB.

Cross Lanes to Rokeby

2.5.84 See Figure 2-1 (Sheet 5 of 7). Cross Lanes to Rokeby is one of the schemes where further consideration of alternative alignment routes is ongoing, in order to further assess and minimise the potential impact upon landowners, heritage assets and to improve traffic movements in the area. The following section describes the alternative alignment routes currently under consideration.

Black Route (included within the Preferred Route Announcement)

2.5.85 The black route would mostly follow the existing alignment, with a new adjacent westbound carriageway constructed to the south between the B6277 junction at Cross Lanes and the existing Tutta Beck Cottage access. Both carriageways would then be routed to the south of The Old Rectory and St Mary's Church, re-joining the existing A66 at Rokeby.

2.5.86 The existing junction at Cross Lanes would be upgraded to a compact grade separated junction, maintaining and improving access to the B6277 (Moorhouse Lane) for Barnard Castle, Cross Lanes Organic Farm Shop and Café, Grade II listed Cross Lanes Farm House and other local farms and residential properties.

2.5.87 The existing A66 would be de-trunked west of St Mary's Church to the local road known as Barnard Castle Road. Here a new compact grade separated junction would be constructed to allow access to Barnard Castle Road via the de-trunked A66, Rokeby and other local properties. This new junction maintains existing HGV access to Barnard Castle.

2.5.88 A new culvert would also be constructed to accommodate Tutta Beck.

Alternative Alignment Routes

2.5.89 A number of alternative alignment routes to the black route are now under further detailed consideration for this scheme. To aid description of these alternatives, this scheme has been divided into two sections – Cross Lanes and Rokeby – as follows:

- Cross Lanes – there are two possible routes: black and blue.
- Rokeby (beginning east of St Mary's Church) - there are four possible routes: black, green, orange and red.

2.5.90 At this stage in the project, it is possible that the route eventually selected for this scheme could comprise any combination of the alternatives described in each section. There are therefore eight possible route variations under consideration:

- Black + black (Preferred Route Announcement for both Cross Lanes and Rokeby)
- Black + green (Preferred Route Announcement for Cross Lanes with an alternative route for Rokeby)
- Black + orange (Preferred Route Announcement for Cross Lanes with an alternative route for Rokeby)
- Black + red (Preferred Route Announcement for Cross Lanes with an alternative route for Rokeby)
- Blue + black (An alternative route for Cross Lanes with the Preferred Route Announcement for Rokeby)
- Blue + green (An alternative route for both Cross Lanes and Rokeby)
- Blue + orange (An alternative route for both Cross Lanes and Rokeby)
- Blue + red (An alternative route for both Cross Lanes and Rokeby)

Cross Lanes

Blue Route (Western Alternative Route)

2.5.91 The blue route would mostly follow the existing alignment. A grade separated junction would be constructed on the A66 linking Rutherford Lane to the south and the B6277 Moorhouse Lane to the north, located west of the existing Cross Lanes priority junction. All movements between the A66, Rutherford Lane and the B6277 Moorhouse Lane would be maintained.

2.5.92 A new adjacent westbound carriageway would be constructed to the south between the B6277 junction at Cross Lanes and the existing Tutta Beck Cottage access.

2.5.93 A new culvert would also be constructed to accommodate Tutta Beck.

Rokeby

Black Route (included within the Preferred Route Announcement)

2.5.94 This includes an overbridge junction to the west of St Mary's Church that avoids direct impacts on the Registered Park and Garden and The Old Rectory.

2.5.95 The existing A66 would be de-trunked alongside St Mary's Church and the Registered Park and Garden and maintained as a local road to provide access to St Mary's Church, and to connect to Barnard Castle Road.

Green Route

2.5.96 For the green route the junction would be sited to the west of St Mary's Church and would sit beneath the A66 with an underbridge to reduce the visual impact on the church. The A66 would remain offline as per the Preferred Route Announcement to retain The Old Rectory.

Orange Route

2.5.97 The orange route would be as per the green route, however the mainline would be moved closer to the existing A66. This would require demolition of The Old Rectory but would significantly reduce land take to the south.

Red Route

2.5.98 For the red route the junction would be moved to the east and pass beneath the A66 in an underpass to minimise the impact. This route would span the registered park and garden at its narrowest point. Direct construction impacts would be reinstated post-construction, including the existing path which connects St Mary's church with the registered park and garden.

2.5.99 This route as currently shown would require demolition of The Old Rectory, however work is ongoing to determine if there is a design solution which avoids this.

Stephen Bank to Carkin Moor

2.5.100 See Figure 2-1 (Sheet 6 of 7). Stephen Bank to Carkin Moor is one of the schemes where further consideration of alternative alignment routes is ongoing, largely in relation to the Moor Lane junction to improve safety and incorporate feedback received from the community. The following section describes the alternative alignment routes currently under consideration.

Black Route (included within the Preferred Route Announcement)

2.5.101 The black route would comprise a new dual carriageway section between Stephen Bank and Carkin Moor Farm. The new dual carriageway would be to the north of the existing A66 and the properties at Fox Hall and Mainsgill Farm, rejoining the existing A66 alignment after Mainsgill Farm. The road would be widened through Carkin Moor scheduled monument to Carkin Moor Farm (within the existing cutting).

2.5.102 The existing A66 would be de-trunked at this location and would be used as a collector road for local access. In order to maintain existing access, this section of road would be realigned over a distance of 600m to facilitate the lowering of Collier Lane.

2.5.103 A new grade separated junction on Moor Lane would be provided to allow for safe and easy access to the existing A66, the villages of East Layton, West Layton, Ravensworth and Mainsgill Farm Shop.

2.5.104 The existing right turn to Warrener Lane would be removed with traffic joining the A66 via a new link road to Moor Lane grade separated junction.

2.5.105 The new alignment severs existing access to fields to the east of Stephen Bank. Proposals for alternative access to these fields are currently being developed.

Blue Route

2.5.106 The blue route includes provision of a new grade separated all movement junction to the west of Moor Lane, providing connectivity between the de-trunked A66 and the proposed mainline . The new grade separated junction would comprise an overbridge which carries the new link above the proposed A66 mainline.

2.5.107 The link has been positioned to ensure adequate spacing between adjacent junctions and that its vertical profile is kept to a minimum by placing it at a point at which the mainline of the A66 is in cutting. The existing alignment of Moor Lane would be retained, providing connectivity from the de-trunked A66 to the village of East Layton. Moor Lane would be placed in a cutting beneath the A66 mainline which would pass above broadly at grade with the existing surroundings.

Green Route

2.5.108 The green route also includes provision of a new grade separated all movement junction to the western boundary of the existing alignment of Moor Lane, providing connectivity between the de-trunked A66 and the proposed mainline.

2.5.109 The southern section of Moor Lane would be realigned and placed into a cutting beneath the proposed mainline and ultimately connected to the de-trunked A66 to the west of its current location, introducing a safe stagger arrangement with surrounding junctions. The existing bridleway would be rerouted along the proposed realigned section of Moor Lane and along the Western Boundary of Mainsgill Farm. The existing bridleway which proceeds through Mainsgill Farm would be stopped up.

Orange Route

2.5.110 The orange route incorporated west-facing slip roads at Collier Lane and east-facing slip roads at Moor Lane. At Collier Lane, the proposed mainline of the A66 would be placed in cutting and connectivity provided to the local road network via slip roads leading to Collier Lane, which would pass broadly at grade above.

2.5.111 At Moor Lane, the proposed mainline of the A66 would pass through the area broadly at grade, and connectivity would be provided to the local road network via slip roads leading to Moor Lane which would be placed in a cutting beneath.

A1(M) J53 Scotch Corner

2.5.112 See Figure 2-1 (Sheet 7 of 7). The only component of this scheme at this location is the widening of the Middleton Tyas Lane approach to the A1(M) Junction 53 at Scotch Corner roundabout, from one lane to two lanes.

2.5.113 A section of footway, some signs and lighting columns would require relocation to the back of the widened carriageway and road markings would be required to tie in with existing.

2.6 Assessment Years

2.6.1 The EIA will assess the environmental impacts of the project at key stages of both the construction and operational phases. Where appropriate, these will be compared to the pre-construction (i.e. current) baseline and, if relevant, to the situation that would be expected to prevail in the future in absence of the proposed works (i.e. the projected future baseline).

2.6.2 The current construction strategy assumes a phased approach to construction across four packages of work, meaning that it is likely some parts of the project will be operational whilst others are under construction. The assessment will therefore also consider whether any significant effects could arise during a partial opening phase, where construction is ongoing.

2.6.3 The assessment carried out at earlier stages of assessment was based on a phased construction programme of seven years commencing in 2024 and the route being fully open in 2031. Work is ongoing, however, to review both a 10-year construction programme (as set out in *RIS2*) and an accelerated 5-year construction programme. It is currently anticipated that the construction activities would commence in 2024 and the scheme open to traffic in 2029 (following a 5-year accelerated construction programme). The construction of the various packages may overlap, though no detail on this is currently available. This will be considered further in the ES, which will clearly set out the assumed packages, phasing and opening years for each scheme and how this has informed the assessments.

2.7 Construction Methodology and Phasing

2.7.1 The actual start date for the construction phase would depend upon several factors including the grant of a DCO. The construction programme would be finalised by the contractor in advance of the works. An outline construction programme, including the duration, anticipated phasing, working hours and any requirement for night time working will be presented in the ES.

2.7.2 The detailed methodology for construction of the project is not yet known. Where possible, information relating to the potential location of site compounds and haul routes will be provided to inform an assessment of construction impacts in the ES. As the details of construction are unlikely to be known until later stages, professional judgement and reasonable assumptions will be used – and clearly stated - to ensure that an assessment of the likely worst-case effects of construction is presented. It is likely that a risk-based approach will be taken to the construction assessment and mitigation measures to be proposed where significant effects may occur.

2.8 Construction Environmental Management

2.8.1 Measures identified through the EIA process to further prevent, reduce and, where possible, offset any adverse effects on the environment will be described in the relevant topic chapters in the ES. These essential mitigation measures will be summarised in the Register of Environmental Actions and Commitments (REAC), contained within a document known as the Environmental Management Plan (EMP), a draft of which will be submitted as part of the DCO application.

2.8.2 Where the project design and the parameters included in the DCO allow for some flexibility in design or how aspects of the project are constructed, the EMP will specify the mitigation objective to be achieved and any specific constraints on the design, construction or operation that need to be implemented, but allows for flexibility in the

specific mitigation implemented to ensure that the mitigation as implemented achieves the intended outcome. Where relevant, indicative layouts of mitigation measures will be shown on the visual Environmental Mitigation Plans submitted as part of the DCO application and included in the EMP.

2.8.3 It is important to note that the precise content of the Environmental Mitigation Plans will not be intended to be 'secured' by way of the DCO – instead, they will present indicative layouts to show how the relevant mitigation measures could be implemented so as to be effective in terms of mitigating effects. However, as detailed design progresses it may be the case that the layout indicated on the Environmental Mitigation Plans needs to be altered. Importantly, this could only be done insofar as the layout complies with the EMP.

2.9 Maintenance During Operation

2.9.1 Maintenance would be authorised under the DCO. As required by Design Manual for Roads and Bridges (DMRB), industry standard control measures would be applied and encapsulated in the Handover EMP (HEMP) at the end of construction. With the implementation of these measures no significant effects from maintenance are considered likely that will not already be considered for the construction phase and so maintenance activities are not proposed to be considered separately.

2.10 Decommissioning

2.10.1 The traffic assessment demonstrates that the proposed improvements would operate adequately in the Design Year of 2044 (15 years after opening). Typically, highways schemes are designed to have a materials (e.g. pavements, etc.) lifespan of between 20 and 40 years before major maintenance and upgrading is required, dependent on material properties, maintenance and usage. Elements including structural concrete and steelwork have extended design lives of up to 120 years.

2.10.2 It is considered highly unlikely that the project would be decommissioned as the road is likely to become an integral part of the infrastructure in the area. Decommissioning would not be either feasible or desirable and is therefore not proposed to be considered in the EIA.

3 Assessment of Alternatives

3.1 Introduction

3.1.1 This chapter provides an overview of the development of the project to date and the process of selecting the preferred route from alternatives considered. It then provides an outline of the proposed scope of the assessment of alternatives that will be reported in the Environmental Statement (ES).

3.1.2 A description of the alternatives considered and the reasons for the selection of the chosen alternatives at each stage will be set out within the ES.

3.2 Background to the optioneering process

3.2.1 All major trunk road projects are progressed through the Highways England major project lifecycle steps as shown in Table 3-1.

3.2.2 The project is currently at Project Control Framework (PCF) Stage 3 (Preliminary Design).

Table 3-1: PCF Stage 1 topic Specific Consultation

0 Strategy, shaping and prioritisation	Identification and prioritisation of potential transport issues.
	Shaping, investigation and assessment of the viability of transport scheme solutions to the problem, including road network solutions.
	Produce a strategic outline business case.
	The initiation of a major roads project (if deemed the most viable solution to the transport issue).
1 Option identification	Identify options to be taken to public consultation.
	Assess options in terms of environmental impact, traffic forecasts and economic benefits.
	Refine the cost estimate of options (including an allowance for risk).
2 Option selection	Carry out public consultation including exhibitions.
	Analyse comments received and select a preferred option.
	Refine the cost estimate for preferred option (including allowance for risk).
	Refine the environmental impact assessment, traffic forecasts, and economic benefits following public consultation if required.
	Produce an outline business case.
	Announce the preferred route.
3 Preliminary design	If Early Contractor Involvement (ECI) procurement method selected, appoint contractor.
	Carry out surveys (such as topographical, geotechnical, environmental).
	Undertake consultation, complete consultation report and resolve or rebut outstanding issues.
	Complete and freeze the preliminary design of the preferred route.

	Prepare orders (*Planning Act 2008 (as amended)* (Legislation, 2008a) [13]).
	Complete the environmental assessment and prepare the ES.
	Agree initial target cost with ECI contractor (if applicable).
4 Statutory procedures and powers	Publish notice of acceptance of *Planning Act 2008 (as amended)* Development Consent Order (DCO) application and ES as appropriate.
	Arrange public inquiry (if required).
	Under the *Planning Act 2008* the Planning Inspectorate will decide on the preliminary meeting and examination of the DCO application. We will need to register and comment as applicant.
	Present evidence and rebuttals to objections.
	The planning inspectorate panel or inspector will make recommendations to the secretary of state.
	Issue secretary of state's decision letter confirming a made DCO.
5 Construction preparation	Respond to any high court challenges (if any).
	Obtain approval to any advance works or advance statutory undertakers' diversions.
	Agree costs of construction with the contractor. If ECI is procurement method, agree final target cost.
	Produce the final business case.
	For *Planning Act 2008* (as amended) schemes place details of land to be acquired on deposit and publish a notice to say where these can be inspected.
	Obtain notice to proceed.
6 Construction, commissioning and handover	Make general vesting declaration or issue notices to treat and enter and take possession of land (if applicable).
	Complete detailed design.
	Construct and commission scheme.
	Hand over asset for operation with as-built drawings and health and safety file.
	Open scheme to traffic.
7 Closeout	Agree final account with contractor.
	Contractor completes outstanding works (or re-work).
	Complete a review of project delivery.
	Initiate Post Opening Project Evaluation (POPE) process.

[13] Legislation (2008a) Planning Act 2008 (as amended), available at: https://www.legislation.gov.uk/ukpga/2008/29/pdfs/ukpga_20080029_en.pdf

3.3 Strategy shaping and prioritisation

3.3.1 In 2014 (Department for Transport, 2014a)[14] the Government announced that it intended to examine the case for dualling one of the routes across the Pennines to improve east / west connectivity in the north of England.

3.3.2 In 2017 (Highways England, 2017)[15] it was announced that the A66 had presented the strongest case for upgrade and that plans for full dualling between the M6 junction 40 and the A1(M) at Scotch Corner would be developed for the next Road Investment Strategy.

3.4 Overview of optioneering process

3.4.1 Figure 3-1 presents the overall option development and appraisal process which was undertaken for the A66 during Option Identification (PCF Stage 1), Option Selection (PCF Stage 2) and the process currently being undertaken as part of Preliminary Design (PCF Stage 3).

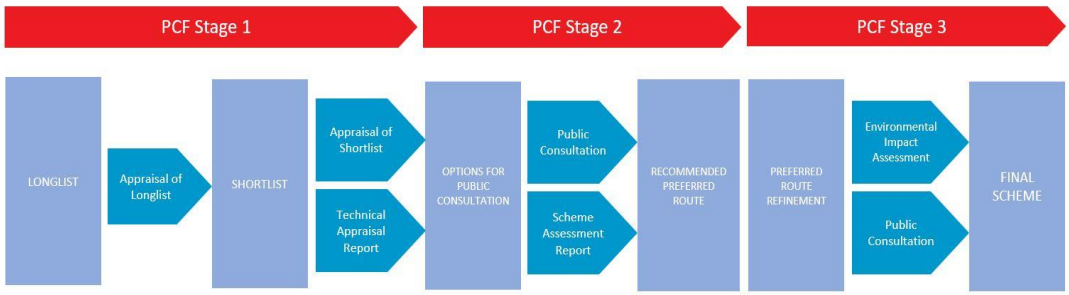


Figure 3-1: PCF Process Overview

Option Identification Stage

3.4.2 A two-stage process was used during the Option Identification stage, the first stage being a longlist appraisal undertaken in February 2018 and the second being a shortlist assessment completed in November 2018 and refined at the Option Selection stage. The Option Identification appraisal work is documented in the *Technical Appraisal Report (TAR)* (document reference: HE565627-ARC-HGN-A66-RP-ZM-1082) (Highways England, 2018a)[16] and the environmental assessment is presented in *the Environmental Assessment Report (EAR)* (document reference: HE565627-ARC-EGN-A66-RP-ZM-1055) (Highways England, 2018b)[17].

Longlist Appraisal (Option Identification)

3.4.3 The longlist appraisal followed a bespoke methodology developed by Arcadis and Highways England which took account of the requirements of the *National Policy*

[14] Department for Transport (2014a) Road Investment Strategy: Overview, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/382808/dft-ris-overview.pdf
[15] Highways England (2017) North Pennines Route Strategy, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/600328/North_Pennines_Final.pdf
[16] Highways England (2018a) A66 PCF Stage 1 Technical Appraisal Report
[17] Highways England (2018b) A66 PCF Stage 1 Environmental Assessment Report

Statement for National Networks (NPSNN) (Department for Transport, 2014b)[18]. Further details of the methodology used and the results of the longlist appraisal process are documented in the *Longlist Appraisal Summary Report* (document reference: HE565627-ARC-GEN-ZZZ-RP-Z-1043) (Highways England, 2019a)[19].

3.4.4 Given the large number of European and national level constraints along and adjacent to the A66, a number of the longlist options were rejected for environmental reasons.

Shortlist assessment process (Option Identification)

3.4.5 The shortlist assessment involved engineering, environmental, traffic, economic, constructability, operation, maintenance and safety assessment. The assessment of the shortlist was undertaken at a 'whole-route' level and a sub-route level. This approach was taken due to the number of shortlisted options and the fact that several different options could be combined to create a single dualled A66. This was also important for defining how the traffic modelling was undertaken which provided the basis for some of the environmental topic assessments.

3.4.6 The two 'whole-route' options assessed were:

- Route 1 – a combination of the shortest options in each section to create a whole route
- Route 2 – a combination of the longest options in each section to create a whole route

3.4.7 Traffic modelling was undertaken for the above two scenarios.

3.4.8 The following approach was undertaken for the environmental assessment:

- The Biodiversity, Climate, Cultural Heritage, Geology and Soils, Landscape and Visual, Materials resource and waste, Population and Health and Road Drainage and Water Environment chapters of the *EAR* assessed each of the shortlisted options individually, allowing for the effects of each sub-route to be understood. In addition, the two 'whole route' options outlined above were considered qualitatively.
- Air Quality, Noise and Climate (Greenhouse Gas (GHG) emissions) assessed the two 'whole route' options only.

3.4.9 This assessment helped to identify the main environmental risks that needed to be considered when selecting the proposed route at Option Selection stage.

Option Selection Stage

3.4.10 In accordance with PCF guidance the *EAR* was reviewed and updated at the Option Selection stage.

3.4.11 A third 'whole-route' option was assessed at Option Selection stage in addition to Route 1 (shortest route) and Route 2 (longest route). This comprised a combination of options which were presented at consultation events in summer 2019, referred to as the 'Emerging Preferred Route' (see Chapter 4: Consultation). In addition a limited number of targetted surveys were undertaken where potential significant environmental effects were identified, to ensure the assessment carried out was

[18] Department for Transport (2014b) National Policy Statement for National Networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf
[19] Highways England (2019a) A66 PCF Stage 1 Longlist Appraisal Summary Report

robust for option comparison purposes. This assessment fed into the option appraisal process and informed the subsequent consultation.

3.4.12 The consultation in Summer 2019 presented the route as seven sections and Kemplay Bank roundabout, with a total of 15 options. An overview of the options, consultation responses, and main reasons for the selection of the Preferred Route are described in the document titled *"A66 Northern Trans-Pennine Public Consultation"* (Highways England, 2019b)[20].

3.4.13 Following consultation all responses were compiled into *Northern Trans-Pennine Options Consultation Report* (Highways England, 2019c)[21]. The option designs were then refined, incorporating the comments provided where practicable. The preferred route for the project was announced in Spring 2020.

Preliminary Design Stage

3.4.14 At Preliminary Design stage, further surveys and investigations are being undertaken on the Preferred Route, as described in this Environmental Scoping Report (ESR) and to be agreed through the scoping and ongoing consultation process, to inform the evolution of the scheme design. These surveys and investigations will also provide information for the assessments which will underpin Highways England's future consultations and the DCO application.

3.4.15 During the development of the preliminary design a number of alternative alignment routes will continue to be considered in relation to specific aspects of the design, for example alternative junction arrangements, drainage design and private means of access. This process of design development is informed by environmental assessment, landowner liaison, consultation and a range of design and buildability factors. Where alternatives are considered, the assessment of alternatives chapter of the ES will set out the environmental factors taken into consideration and the main reasons for the selection of the preferred alternative for inclusion in the preliminary design.

3.4.16 As described in Chapter 2: The Project, in addition to the design development of the project, as a result of further work ongoing to understand the baseline environment and further development of the design of the Preferred Route, it was considered appropriate to undertake some further detailed appraisal of alternative aligmment routes at this stage. Chapter 2: The Project clearly sets out which schemes this affects, and describes any alternatives still under consideration at the time of submitting this ESR. Where the ongoing consideration of alternatives affects some schemes, the widest geographical limits of potential scheme alternatives has been used to define the study area for each topic.

3.4.17 In accordance with PCF guidance, the ES produced at the Preliminary Design stage will include a review of the previous *EAR* and updated assessment to account for any of the following changes:

1) in the project objectives
2) in the physical characteristics and/or location of the project (including any additional or amended options, or the definition of the preferred option)
3) in the assessment limitations and assumptions (e.g. the construction or design year)

[20] Highways England (2019b) A66 Northern Trans-Pennine Public Consultation
[21] Highways England (2019c) A66 Northern Trans-Pennine Options Consultation Report

4) in the level of understanding of the current state of the environment and the potential effects of the development (e.g. due to greater and more detailed data availability)
5) in legislation, policy and guidance/advice relating to any environmental topic
6) in response to stakeholder consultation

3.4.18 The ES will describe the assessment of alternatives undertaken up to and including Preliminary Design stage, including a comparison of the environmental effects and the main reasons for selecting the final proposed route alignment for the project.

4 Consultation

4.1 Introduction

4.1.1 This section outlines the consultation that was undertaken during earlier stages of the project and the further consultation that is proposed as part of the Environmental Impact Assessment (EIA). The focus of this section is solely upon environmental engagement although it should be noted that there is a programme of engagement undertaken by the wider project team including Stakeholder Reference Groups and focus groups; with other organisations; and with the public as part of the project development and pre-application process.

4.2 Consultation undertaken at Option Identification stage

4.2.1 Consultation with the Statutory Environmental Bodies (SEB) commenced with a workshop held on 19 January 2018. The event was attended by the Environment Agency, Natural England and Historic England. The Marine Management Organisation were not invited owing to the nature and location of the project being remote from marine areas. The purpose of the workshop was to:

- Provide an update on the development of the project
- Review the environmental appraisal process
- Review environmental interests and issues
- Present the longlist options that had been discounted to date
- Review the future engagement programme

4.2.2 The SEB provided feedback during the workshop that they were in agreement regarding the longlist appraisal methodology and the longlist options that had been proposed for discounting. Future lines of engagement were also discussed, and it was proposed that there would be a further workshop during April 2018 to present the shortlisted options and the proposed assessment method as outlined in this Environmental Scoping Report (ESR).

4.2.3 A second workshop was held with SEB on 1 May 2018. Its purpose was to:

- Provide an update on the project and environmental appraisal progress.
- Explain how the previous SEB feedback has informed the discounting of longlist options.
- Present the shortlist project options.
- Outline the approach to the shortlist assessment by topic.

4.2.4 The SEB agreed the approach to the assessment of the short list project options and were satisfied with how previous feedback had been taken into consideration. Furthermore, drawings of the shortlisted project options were given to SEB for internal consideration and to allow an opportunity to provide further feedback.

4.2.5 A consultation workshop was also held with non-statutory environmental bodies on 15 February 2018 to outline the progress to date and to understand their initial views. The organisations that attended were Durham Wildlife Trust, Eden Rivers Trust, Forestry Commission, National Trust, Royal Society for the Protection of Birds (RSPB) and the Woodland Trust.

4.2.6 Table 4-1 presents the environmental topic specific consultation which was conducted to inform the Option Identification stage *Environmental Assessment Report (EAR)* (Highways England, 2018)[22].

Table 4-1: Option Identification stage topic-specific consultation

Topic	Consultee	Reason for Consultation
Air Quality	Eden District Council Durham County Council Richmondshire District Council	To obtain latest air quality monitoring review and assessment reports.
Biodiversity	Cumbria Biodiversity Data Centre (CBDC) Environmental Records Information Centre North East (ERICNE)	To obtain latest records of protected and notable species within the local area of the project.
	North & East Yorkshire Ecological Data Centre (NEYEDC)	To obtain latest records of protected and notable species within the local area of the project.
	Environment Agency	To obtain the latest records of fish and aquatic invertebrate / crayfish within the local area of the project.
	Charles Fletcher (Yorkshire county recorder for macro-moths) Harry Beaumont (Yorkshire county recorder for micro-moths) Keith Dover (Durham county recorder for macro-moths) Tim Barker (Durham county recorder for micro-moths) Bob Marsh (Yorkshire county recorder for Coleoptera)	To obtain the latest records of invertebrates within the local area of the project.
	Cumbria Bird Club Durham Bird Club Ian Court (North Yorkshire County bird recorder) North Cumbria Barn Owls Study Group Paul Willet (North Yorkshire Barn Owl recorder)	To obtain the latest records of birds within the local area of the project.
	Cumberland Bat Group South Cumbria Bat Group North Yorkshire Bat Group Durham Bat Group	To obtain the latest records of bats within the local area of the project.

[22] Highways England (2018) A66 PCF Stage 1 Environmental Assessment Report

Topic	Consultee	Reason for Consultation
	Durham Badger Group North Riding Badger Group	To obtain the latest records of badger within the local area of the project.
Climate	No consultation at this stage.	
Cultural Heritage	Engaged with Historic England to discuss the shortlisted options. Obtain Historic Environment Record (HER) data	To inform the assessment and supplement existing baseline data.
Geology and Soils	No consultation at this stage.	
Landscape Effects	No consultation at this stage.	
Materials	No consultation at this stage.	
Noise	No consultation at this stage.	
Population and Health	Eden District Durham County Richmondshire District	To verify Public Rights of Way (PRoW) data.
Road Drainage and the Water Environment	Environment Agency Eden District Council Richmondshire District Council Durham County Council Lead Local Flood Authority (LLFA) Cumbria County Council LLFA North Yorkshire LLFA United Utilities	To obtain data relating to flood extents, flooding history, surface water quality, groundwater levels, groundwater quality, abstractions (licenced and private) and discharges. To confirm the approach for the assessment, notably regarding flood risk.
Cumulative Effects	No consultation at this stage – all development searches web-based.	

4.3 Consultation undertaken at Option Selection stage

Consultation with statutory and non-statutory environmental bodies

4.3.1 A meeting was held with the Environment Agency and Natural England on 21 January 2019 and with Historic England on 22 January 2019. The aim of these meetings was to present the findings of the Option Identification stage and discuss the scope of the assessment to be undertaken at the Option Selection stage. The following feedback was provided, and was taken into account in developing the route options:

- Natural England recommended undertaking further ecological surveys along the options at Temple Sowerby to Appleby including a corridor survey of the River Eden.
- The Environment Agency recommended flood risk modelling be undertaken for options at Temple Sowerby to Appleby.
- Opportunities for net biodiversity gain should be considered.

- Historic England commented that the alignment of the A66 should be considered as a significant cultural heritage asset itself and any deviation of the route to avoid individual heritage assets may be detrimental to the historic context of the A66 and individual assets. It was also recommended that further information be obtained on the Scheduled Monument at Carkin Moor (SM6) and to reconsider screening options at Penrith to Temple Sowerby and Temple Sowerby to Appleby.

4.3.2 A letter received from Natural England, dated 1 March 2019, confirmed that Phase 1 habitat survey should be undertaken at locations within Section 6: Temple Sowerby to Appleby in order to inform the Option Selection stage. It also noted that surveys should consider the hydrological links to the River Eden and floodplains. Further meetings took place following public consultation and prior to the announcement of the preferred route.

4.3.3 Consultation with non-statutory environmental bodies was also undertaken at Option Selection stage. The following environmental interest groups were invited to a focus group on 14 March 2019:

- Campaign for Better Transport/Friends of the Earth
- Campaign to Protect Rural England
- Coal Authority
- Cumbria Wildlife Trust
- Durham Wildlife Trust
- Forestry Commission
- Friends of the Lake District
- Garden History Society
- Lake District National Park Authority
- National Parks Authorities
- National Trust
- North Pennine Area of Outstanding Natural Beauty (AONB)
- RSPB
- Sustrans North
- Yorkshire Dales National Parks Authority

4.3.4 **Error! Reference source not found.**presents the environmental topic specific consultation which was conducted at Option Selection stage:

Table 4-2: Option Selection stage topic-specific consultation

Topic	Consultee	Reason for Consultation
Air Quality	Eden District Council Durham County Council Richmondshire District Council	To obtain the latest air quality monitoring review and assessment reports.
Biodiversity	Natural England	To agree the scope for habitat surveys to inform option selection.
Climate	No consultation at this stage.	
Cultural Heritage	Continued consultation with Historic England. Begin consultation with County	To inform the assessment and supplement existing baseline data.

Topic	Consultee	Reason for Consultation
	Archaeologists of effected local authorities.	
Geology and Soils	British Gypsum Coal Authority	To obtain details of gypsum and coal mining information to supplement existing baseline data.
	Environment Agency Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council	To obtain details of waste management facilities, current and historical landfill site to supplement existing baseline data.
Landscape and Visual	Eden District Council Durham County Council Cumbria County Council Richmondshire District Council	To confirm Tree Preservation Order and Important Hedgerows.
Materials and Waste	No consultation at this stage.	
Noise and Vibration	No consultation at this stage.	
Population and Health	No consultation at this stage.	
Road Drainage and the Water Environment	Environment Agency	To obtain data for the River Eden to input into flood risk model.
	Eden District Council Richmondshire District Council Durham County Council Lead Local Flood Authority (LLFA) Cumbria County Council LLFA North Yorkshire LLFA	To obtain further information about local sources of flood risk and standards for the management of surface water runoff from the road.
Cumulative Effects	No consultation at this stage – all development searches web-based.	

Public consultation

4.3.5 Public consultation was undertaken in Summer 2019 to provide local stakeholders with an overview of the project and present the public with an opportunity to provide their feedback and opinions on the proposed options.

4.3.6 Public consultation was held on the following dates:

- Penrith: 17 to 18 May, 4 to 6 June and 17 to 18 June 2019
- Appleby: 29 May to 1 June 2019

- Barnard Castle: 12 to 15 June 2019
- Richmond: 16 May, 22 to 23 May and 21 to 22 June 2019

4.3.7 An overview of the options, consultation responses, and main reasons for the selection of the Preferred Route are described in the document titled *"A66 Northern Trans-Pennine Public Consultation"* (Highways England, 2019)[23].

4.4 Preliminary Design stage consultation

Consultation with statutory and non-statutory environmental bodies

4.4.1 Consultation will continue with SEB, the Local Planning Authorities (LPA) and other organisations throughout the Preliminary Design stage, including to inform the ongoing consideration of alternative alignment routes and alternative junction arrangements. This will be an ongoing process, including the development of the Evidence Plan for the project (see section 5.8). This will also form part of the formal statutory consultation to support the DCO as required under Section 42 of the *Planning Act 2008 (as amended)* (Legislation, 2008)[24].

4.4.2 Table 4-3 describes consultation that has been undertaken to date during the Preliminary Design stage, and the consultees engaged. Some of this has taken place prior to the formal EIA scoping process, and is continuing throughout. This list is not exhaustive, and a wider range of consultees with interest in environmental aspects of the project (including all organisations that were consulted during earlier stages) will be engaged and invited to contribute to and comment on the preliminary design and assessment work, through Focus Groups, Technical Working Groups (TWG) and on specific issues or scheme locations throughout the process.

Table 4-3: Preliminary Design stage topic-specific consultation

Topic	Consultee	Reason for Consultation
Air Quality	Natural England	To agree ecological sites to be assessed and assessment methodology.
	Eden District Council Durham County Council Richmondshire District Council	To obtain the latest air quality monitoring review and assessment reports.
Biodiversity	Natural England	Consultation on planned surveys to agree scope, frequency and methodology and follow ups to review and agree findings and mitigation. Agree assessment methods and targets relating to biodiversity metrics. Agreement of detail of assessments for key specific issues/locations (e.g. protected

[23] Highways England (2019) A66 Northern Trans-Pennine Public Consultation
[24] Legislation (2008) Planning Act 2008 (as amended), available at: https://www.legislation.gov.uk/ukpga/2008/29/pdfs/ukpga_20080029_en.pdf

Topic	Consultee	Reason for Consultation
		sites) and to discuss and agree mitigation.
	Environment Agency	Gather and collate existing Environment Agency survey data for: Aquatic macroinvertebrates Fish Macrophytes Consultation on aquatic survey methodology and assessment approach including use of biodiversity metrics.
	Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council	To obtain biodiversity records where updates are required. Consultation on proposed surveys, identified impacts and mitigation.
	Local biodiversity record centres (Cumbria Biodiversity Data Centre (CBDC), Environmental Records Information Centre North East (ERICNE), North & East Yorkshire Ecological Data Centre (NEYEDC)), non-statutory organisations, local groups and recorders (badger, bats, birds, invertebrates).	To consult and obtain biodiversity records where updates are required.
Climate	Natural England	To discuss methodology of the assessment with regards to land use and land use change.
	Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council	To consider any local climate change matters (e.g. targets or budgets), which may be relevant to the assessment.
Cultural Heritage	Historic England County Archaeologists: Cumbria County Council, Durham County Council, North Yorkshire County Council Conservation Officers: Eden District Council, Durham County Council and Richmondshire District Council Milestone Society	Consultation on planned surveys to agree scope, frequency and methodology for surveys and follow ups to review and agree findings. Agreement of detail of assessments for key specific issues/locations (e.g. protected sites) and to discuss and agree mitigation.

Topic	Consultee	Reason for Consultation
	Churches Conservation Trust Roman Roads Research Association	
Geology and Soils	Natural England	Consultation to agree scope of agricultural soils surveys and assessment, agree findings and mitigation measures.
	Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council	To obtain details of potential contamination sources (including Part IIA contaminated land, waste management facilities, current and historical landfill sites, burial pits) and geological designations to supplement existing baseline data.
		To consult if mitigation is required
	British Geological Survey (BGS) Geological Society Regional Groups	To obtain details of any geological designations or geologically sensitive/valuable non-designated features.
	Animal and Plant Health Agency National Farmers' Union (NFU)	To obtain details of any recorded animal burial pits.
	British Gypsum	To obtain further details of gypsum mining and any associated land quality issues to supplement existing baseline data.
	Ministry of Defence (MoD)	To obtain further details of any potential contamination issues at Warcop training camp.
	Environment Agency	To identify any potential contamination concerns and, where appropriate, obtain further information on landfill sites to supplement other baseline data.
		To consult if mitigation is required.
Landscape and Visual Effects	Natural England Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council North Pennines AONB Partnership Yorkshire Dales National Parks Authority	Consultation on extent of visual study area, viewpoint locations, number and type of supporting visualisations/photomontages, assessment methodology, identified impacts and type and extent of landscape mitigation.

Topic	Consultee	Reason for Consultation
Materials	Environment Agency	To obtain details of waste management facilities, current and historical landfill site to supplement existing baseline data.
	Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council	To obtain details of waste management facilities, current and historical landfill site to supplement existing baseline data.
Noise	Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council	To consult on and agree proposed approach to noise assessment, identified impacts and mitigation.
Population and Health	Public Health England and Directors of Public Health for: Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council	To discuss scope of the assessment. Consultation to discuss impacts on development land and PRoW.
	NFU	Consultation to discuss agricultural impacts.
	Large or notable landowners or sensitive community receptors	Consultation to discuss potential impacts of land loss
Road Drainage and the Water Environment	Environment Agency	Confirm the proposed methodology Obtain updated information including groundwater data, discharge data, water quality, flood risk, abstractions, historic flood outlines Identifying any additional sensitivities Confirm hydraulic modelling requirements
	Lead Local Flood Authorities: Eden District County Council Richmondshire District Council Durham County Council Cumbria County Council North Yorkshire County Council	To obtain further information about local sources of flood risk and standards for the management of surface water runoff from the road and confirmation of monitoring schedules. To confirm hydraulic modelling requirements.

Topic	Consultee	Reason for Consultation
		To obtain discharge data, information on abstractions and private water supplies and historic flooding.
Cumulative Effects	Eden District Council Cumbria County Council North Yorkshire County Council Richmondshire District Council Durham County Council	Provide relevant advice on the scope of the assessment of cumulative effects.

Informal scoping consultation

4.4.3 Section 1.3 sets out a number of implications for the EIA process resulting from the optimisation of the A66 NTP delivery programme. In order to inform the planning and programming of the ES, an informal scoping consultation exercise was held with the SEB and LPA in late 2020/early 2021. The aim of this process was to provide an opportunity for key statutory consultees to comment on the developing approach, and to obtain initial feedback on the proposed EIA scope to inform early assessment work.

4.4.4 A draft of this Environmental Scoping Report (ESR), along with a consultation paper specifying the challenges set out in Section 1.3 was shared with the SEB and LPA. A number of those organisations provided responses, which have been taken into consideration in the production of this ESR. A section has been included in each topic chapter of this ESR identifying the key points raised to date through informal scoping consultation and how each has been, or will be, addressed.

Public consultation

4.4.5 Public Consultation is undertaken to provide local stakeholders, the general public, affected landowners and anyone else with an interest in the project with an overview of the project and an opportunity to provide feedback. Formal and informal consultation has been undertaken throughout the project to date, and will continue throughout the Preliminary Design stage.

4.4.6 Formal public consultation (as required under the *Planning Act 2008 (as amended)* is planned for Autumn 2021. Further information on the dates and locations of public consultation events will be publicised in due course.

4.4.7 All responses received during public consultation will be taken into account in the final designs and assessment work, and will feed into the Environmental Statement.

5 Environmental Assessment Methodology

5.1 Introduction

5.1.1 This chapter outlines the overall methodology that will be used to undertake the Environmental Impact Assessment (EIA). The EIA will follow the requirements of the Project Control Framework (PCF), the Design Manual for Roads and Bridges (DMRB), the *Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the EIA Regulations)* (Legislation, 2017)[25] and other relevant guidance.

5.1.2 Details are provided of the methods that will be used as well as the potential limitations and assumptions that need to be acknowledged, recognising that the assessment should be proportionate.

5.2 Surveys and predictive techniques and methods

Proposed study areas

5.2.1 Study areas are individually defined for each environmental topic based on the geographical scope of the potential impacts on receptors/resources and the relevant topic-specific criteria. The study areas for air quality and noise are also influenced by the traffic modelling outcomes, as are the other environmental topics which draw upon them for key information (e.g. climate and population and human health).

5.2.2 The study areas for each topic are described in Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects of this Environmental Scoping Report (ESR).

5.2.3 As described in Chapter 2: The Project, in addition to the design development of the scheme, as a result of further work ongoing to understand the baseline environment and further development of the design of the Preferred Route, it was considered appropriate to undertake some further detailed appraisal of alternative alignment routes and alternative junction arrangements at this stage. Chapter 2: The Project clearly sets out which schemes this affects, and describes any alternatives still under consideration at the time of submitting this ESR. Where the ongoing consideration of alternatives affects some schemes, the widest geographical limits of potential scheme alternatives has been used to define the study area for each topic.

Baseline data gathering/surveys

5.2.4 This ESR presents the baseline information that is currently available for each topic in Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects. This has been established through desk-based research including the collection of pre-existing data, primary data collection through site surveys, and engagement with stakeholders and third parties to gather information relevant to establishing the baseline environment of the site.

5.2.5 A preliminary description of the baseline for each topic will be provided in the Preliminary Environmental Information (PEI) Report, and a full description provided in the Environmental Statement (ES). This will be established using data gathering methods following topic-specific guidelines. It will also involve further engagement

[25] Legislation (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulation (as amended), available at: https://www.legislation.gov.uk/uksi/2017/572/pdfs/uksi_20170572_en.pdf

with stakeholders to obtain any relevant data that they hold (as described in Chapter 4: Consultation).

5.2.6 Where relevant, the baseline description presented in each topic chapter will also consider and report upon the likely future baseline, taking account of likely changes that may take place between the time of assessment and the project itself. This may be, for example, as a result of changes brought about by other committed developments or through anticipated environmental change (natural or otherwise) over time.

5.2.7 At Option Selection stage, primary data collection activities were limited to the field surveys agreed with Statutory Environmental Bodies (SEB) in January 2019 to inform the options selection. However, site reconnaissance surveys were also undertaken by other environmental topic leads for familiarisation and to provide content to the assessment.

5.2.8 The information gathered through surveys was presented at a design workshop in July 2019 to agree the Emerging Preferred Route which was assessed as the third 'whole route' option in the Option Selection stage *Environmental Assessment Report (EAR)* (Highways England, 2018)[26].

5.2.9 To inform the preliminary design and EIA, data collection activities will include field surveys which will be agreed with SEB and non-statutory bodies. Further detail regarding surveying and data gathering is provided in Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects.

Methods

5.2.10 Each individual topic chapter provides details of the methods that will be used to define the baseline and assess effects. These methods draw upon DMRB and other relevant guidance. The level of detail in the assessment is commensurate with the level of design information available at this stage and the proportionality that will be required in each assessment. The methdology adopted, however, will result in a clear and robust assessment what will allow the likely significant effects of the project to be understood including, for example, where assessment parameters are used.

5.2.11 Each topic chapter in the ES will report the results of the assessment in a consistent manner and will include the following sections, split by scheme where applicable:

- Introduction
- Competent Expert Evidence
- Legislative and Policy Framework
- Assessment Methodology
- Assessment Assumptions and Limitations
- Study Area
- Baseline Conditions
- Potential Impacts
- Design, Mitigation and Enhancement Measures
- Assessment of the Likely Significant Effects
- Monitoring

[26] Highways England (2018) A66 PCF Stage 1 Environmental Assessment Report

Mitigation

5.2.12 The EIA will identify mitigation measures using a hierarchical system in line with the requirements of *DMRB LA 104 Environmental assessment and monitoring* (Highways England, 2020)[27]:

- "*Avoidance and prevention: design and mitigation measures to prevent the effect (e.g. alternative design options or avoidance of environmentally sensitive sites).*
- *Reduction: where avoidance is not possible, then mitigation is used to lessen the magnitude or significance of effects.*
- *Remediation: where it is not possible to avoid or reduce a significant adverse effect, these are measures to offset the effect."*

5.2.13 Also in line with *DMRB LA 104*, the ES will report on the following categories of mitigation:

- *"Embedded mitigation: project design principles adopted to avoid or prevent adverse environmental effects. This will be reported in the project description and not repeated in each topic chapter of the ES.*
- *Essential mitigation: measures required to reduce and if possible offset likely significant adverse environmental effects, in support of the reported significance of effects in the environmental assessment. This will be reported in relevant topic chapter of the ES."*

5.2.14 The project is also considering opportunities to deliver environmental enhancements. Where these would be part of the main project they will be included in the Development Consent Order (DCO) application and considered as part of the EIA. Other enhancements which are additional to the main project may be referenced in the ES, but will sit outside the DCO application.

5.3 General assessment assumptions and limitations

Baseline traffic data

5.3.1 In relation to the impact of the Covid-19 pandemic on the baseline, any traffic count data collected post March 2020 would not be considered to be representative of typical conditions. The project team has therefore assumed that traffic distribution patterns from the 2015 mobile network data (factored up to 2019) are sufficiently representative to inform scoping.

5.3.2 In terms of the production of traffic forecasts, the project has followed appraisal advice from DfT's 2020 guidance '*A route map for updating TAG (Transport Analysis Guidance) during uncertain times'* (Department for Transport, 2020)[28], which includes growth revisions reflecting both; anticipated Covid-19 impacts, and, impacts from growth forecasts issued by the Office for Budget Responsibility (OBR), which represent a significant reduction in growth compared to any previous OBR update. The anticipated February 2021 TAG appraisal update has been delayed to May 2021, as such the advice within the July 2020 document will continue to be followed until

[27] Highways England (2020) DMRB LA 104 - Environmental assessment and monitoring, accessed 9th December 2020, https://www.standardsforhighways.co.uk/dmrb/search/78a69059-3177-43dc-94bd-465992cfda82

[28] Department for Transport (2020) Appraisal and Modelling Strategy A route map for updating TAG during uncertain times, accessed 10th March 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/951075/tag-route-map-2020.pdf

further notice. It is anticipated that the traffic data to be used in the EIA and reported in the ES will be based on the guidance within the May 2021 appraisal update.

Level of design information available

5.3.3 Detailed information on the project components (e.g. road section lengths, design specification, temporary and permanent above ground structures) are not yet known but will be described in detail in the ES, and will be used to inform the assessment of environmental effects.

5.3.4 Vertical and horizontal alignments will be provided to a sufficient level of detail to determine how existing accesses onto the A66 will be modified.

5.3.5 Appropriate limits of deviation will be determined and assessed, enabling a robust assessment that allows for a level of flexibility at the detailed design stage. A level of flexibility is essential to enable the design and construction to take account of new factors and to facilitate further design development by the appointed contractor(s), but must be within an assessment envelope that has considered the reasonable worst-case environmental effects. The flexibility will vary depending on the sensitivity of receptors and may be fixed at certain locations to prevent significant effects. Any limits of deviation relied upon for the assessment will be secured via the DCO such that the project cannot be constructed outside of the parameters assessed.

5.3.6 Where limits of deviation or flexibility are retained in the DCO application to aid buildability, this will be clearly described within the ES. Both the ES and DCO application will set out the parameters within which flexiblity has been retained. The ES will therefore be based on the 'Rochdale Envelope' approach where each topic will consider a reasonable worst case within these parameters to ensure that all potential significant effects are identified and appropriate mitigation is secured . In adopting this approach, the project will be embedding flexibility within design and there will be added emphasis on the development of the Environmental Management Plan (EMP) in ensuring appropriate mitigation is applied. This approach will follow the latest guidance and best practice for assessment, including Planning Inspectorate (PINS) *Advice Note 9* (Planning Inspectorate, 2018)[29].

5.3.7 The assumed design speed for the project is 70mph.

5.3.8 The EIA will include consideration of buildability and the construction programme. Where possible, information relating to the potential location of site compounds and haul routes will be provided to inform an assessment of construction impacts in the ES. As the details of construction are unlikely to be known until later stages, professional judgement and reasonable assumptions will be used - and clearly stated - to ensure that an assessment of the reasonable worst-case effects of construction is presented.

Assessment scenarios and assumptions

5.3.9 Where appropriate and if scoped into the environmental topic, the ES will present the effects of the project during both construction and operation. As outlined above there may be more limited details available in relation to construction and so the construction assessment will highlight key potential construction risks in the context of the baseline environment. For example, water pollution during construction is likely

[29] Planning Inspectorate (2018) Advice Note Nine: Rochdale Envelope, available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf

to be a greater risk for those route alignments that involve a new river crossing or where route alignments lie in close proximity to the River Eden for example.

5.3.10 It is proposed that future decommissioning of the operational project will be scoped out of the EIA. This reflects the fact that the A66 is an integral part of national infrastructure and therefore has no intended future decommissioning date. In the event that the project (or any part of it) is to be removed at a future date, this would conform to the statutory processes in place at that time, including EIA as appropriate. If, during the EIA process, however, specific aspects are identified where significant effects could occur during dismantling and replacement of certain elements of the project as they reach the end of design life, this will be considered within the operational assessment of the EIA. This does not apply to effects associated with 'decommissioning' of the construction project such as the removal of site compounds, temporary infrastructure etc. Any effects arising from these activities, and mitigation or reinstatement requirements, will be considered and presented as part of the construction assessment.

5.3.11 It is proposed that transboundary effects will be scoped out of the EIA. Due to the location and nature of the project, the type and location of likely significant effects predicted to arise are very unliklely to be experience as significiant transboundary effects by any other European Economic Area state.

5.4 Significance criteria

5.4.1 *DMRB LA 104* defines the criteria for assigning the significance of the environmental effect as a function of the 'value' of the receptor and the 'magnitude' or 'scale' of the impact. Table 5-1 presents the general approach for assessing the significance of effects however this differs between topics. The specific significance criteria and methods proposed for each topic within the scope of the project are explained further in Chapter 6: Air Quality to Chapter 16: Assessment of Cumulative Effects.

Table 5-1: Typical matrix for the assessment of significance of effects (*DMRB LA 104*)

Sensitivity/ value	Magnitude of Impact				
	No Change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

5.4.2 Where the impact falls into two categories (for example Slight or Moderate) the assessor will use professional judgement to determine the significance of the effect.

5.4.3 In arriving at the significance of effect, the assessor will also consider whether the effect is positive or negative, permanent or temporary, direct, indirect, secondary, cumulative, short, medium or long-term.

5.4.4 In deriving significance scores, the assessor will consider potential mitigation measures that could be viable for reducing effects, recognising that detailed mitigation strategies cannot be developed at this stage.

5.4.5 For further consideration through the scoping and consultation process, it is proposed that the ES will report only the predicted environmental effects that are likely to be significant. Information on other predicted effects assessed but not likely to be significant will be provided in a Technical Appendix in table format.

5.4.6 In line with *DMRB LA 104*, significant effects typically comprise residual effects that are within the moderate, large or very large categories.

5.5 The Environmental Statement

5.5.1 The ES is likely to comprise the following:

- Non-Technical Summary (NTS)
- Volume 1: Environmental Statement (ES)
- Volume 2: Figures
- Volume 3: Technical Appendices

5.5.2 In addition, the following related documents will accompany the DCO application:

- Habitat Regulations Assessment (HRA)
- Environmental Management Plan

5.5.3 The proposed structure of the ES is illustrated in Figure 5-1.

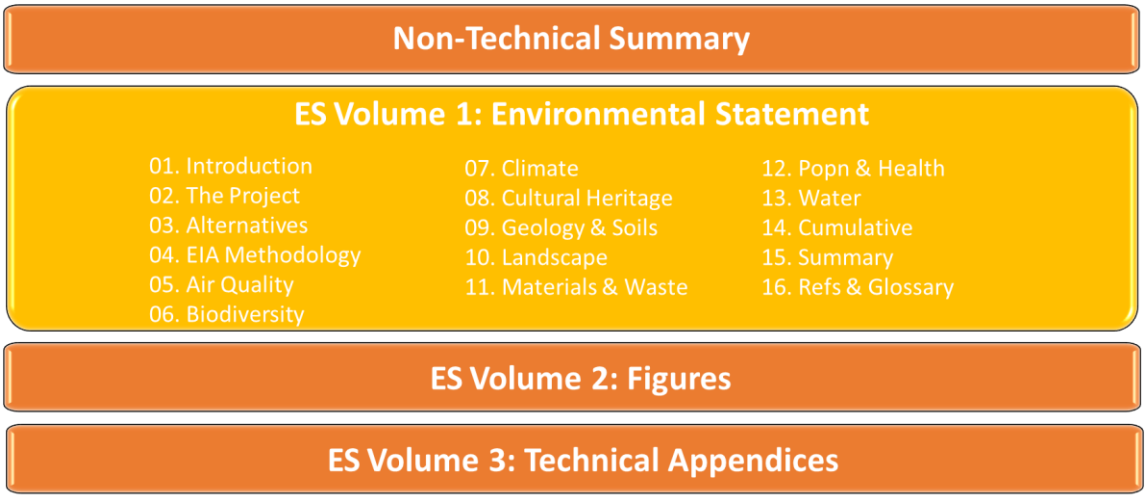


Figure 5-1: ES structure

Proportionality

5.5.4 The project comprises nine individual schemes that will be delivered in four packages. This complexity means that it will be necessary for each environmental topic assessment to identify effects and propose mitigation specific to each scheme as well as considering the potential for routewide effects.

5.5.5 Effects from multiple schemes on a single receptor are not considered to be cumulative effects. Where a receptor is predicted to experience an effect or effects resulting from more than one scheme, the overall predicted effects of the project as a whole (i.e. considering effects arising from any of the schemes) on that receptor will

be reported only once. This will be reported in the scheme within which the receptor is located (or if the receptor is located between schemes, within the scheme it is closest to).

5.5.6 Given the scale and complexity of the A66 Northern Trans-Pennine (NTP) upgrade, it is important that the ES is proportionate and focusses on likely significant effects. All non-significant effects will be reported in a tabular form in an Appendix to demonstrate consideration of all potential effects, but the ES will report only on likely significant effects and the proposed mitigation as required.

5.5.7 The integrated project delivery team is currently looking into a number of possible digital-led solutions to making the ES and associated documents as accessible as possible to all. This may include, for example, hyperlinks to navigate through the assessments based on a user's geographical location or environmental topic of interest, or to enable the user to extract, package up and present parts of assessments, such as by location, by topic, or by other criteria.

5.6 Major events

5.6.1 The *EIA Regulations* require consideration of major accidents and disasters, referred to in *DMRB LA 104* as major events.

5.6.2 *DMRB LA 104* identifies the need to consider major events with reference to:

- Vulnerability of the project to risks of major events
- Any consequential changes in the predicted effects of that project on environmental factors

5.6.3 Scoping for major events therefore requires the project to:

- Apply professional judgement to develop project-specific definitions of major events
- Identify any major events that are relevant to and can affect a project
- Describe the potential for any change in the assessed significance of the project on relevant environmental factors in qualitative terms
- Clearly describe any assumed mitigation measures, to evidence assessment conclusions and demonstrate that likely effects have been mitigated and managed to an acceptable level

5.6.4 *DMRB LA 104* acknowledges that not all events warrant assessment and that evidence should be provided to support the view that they are classified as major events.

5.6.5 Where applicable, an assessment of major events is to be reported within the relevant environmental topic chapters of the ES. Major events is therefore not an environmental topic in its own right.

5.6.6 An assessment of the potential for major events risk as a result of the project is presented in Appendix 18A of this ESR. This concludes that the project is unlikely to result in an unacceptable risk of significant environmental effects from major events and therefore it is proposed that this will be scoped out of the EIA.

5.7 Duplication of assessment

Overview

5.7.1 Other assessments, such as a HRA, are required in order to comply separately with legislation outside of the *EIA Regulations*.

5.7.2 There will be some overlap of information required to inform each of the assessments, particularly in relation to site surveys and the gathering of baseline data. There is a need to minimise unnecessary duplication and to drive efficiency in terms of multiple use of data.

5.7.3 As outlined in the *EIA Regulations* there will be clear co-ordination between the ES and the other assessments required.

Habitats Regulations Assessment

5.7.4 The A66 NTP HRA Screening Assessment for the Option Selection stage was produced in January 2020 and assessed the proposed route shortlisted options. This report followed on from the HRA Screening Assessment that was prepared for the longlist of options in accordance with *PINS Advice Note 10* (Planning Inspectorate, 2017)[30].

5.7.5 The purpose of the HRA Screening Assessment was to provide sufficient data associated with each of the shortlisted options at the Option Selection stage. This was then used to inform the route selection process and to provide a document that could be developed into the Appropriate Assessment for the project. As part of the EIA process, further desk studies, detailed field surveys and stakeholder engagement will be planned in such a way that sufficient information is gained to inform the HRA process. The Screening Assessment has already identified European designated sites which are potentially affected by the Project. These include (refer to Chapter 7: Biodiversity):

- River Eden Special Area of Conservation (SAC)
- Helbeck and Swindale Woods SAC
- Moor House – Upper Teesdale SAC
- North Pennine Moors SAC
- North Pennine Moors Special Protection Area (SPA)

5.7.6 If the Appropriate Assessment concludes that the integrity of the European Site either alone or in combination with other projects/plans in respect of the sites structure and function and its conservation objectives would be adversely affected with mitigation in place, further work would be required. It would need to be demonstrated that there are no alternatives to achieve the Project which would avoid adverse impacts to the integrity of the European Site. Where no alternative solutions exist an Imperative Reasons of Overriding Public Interest (IROPI) case for the Project would need to be prepared. In the event that the Project is then deemed to proceed, compensatory measures would need to be determined.

Flood Risk Assessment and Water Framework Directive Compliance Assessment

5.7.7 A Flood Risk Assessment (FRA) and a Water Framework Directive (WFD) Compliance Assessment will be undertaken alongside the EIA. The ES will use the conclusions of these assessments to determine the extent to which the project could be susceptible to flooding or to increase the risk of flooding elsewhere, and the extent to which the project could impact on the current and future target WFD status of water bodies. Where potential adverse effects are identified, an assessment of these effects will inform what mitigation measures need to be incorporated into the design and

[30] Planning Inspectorate (2017) Advice Note Ten: Habitats Regulations Assessment, available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/06/Advice-note-10v4.pdf

construction methods of the project to remove or reduce the effect. The results will be presented in the ES.

5.8 Evidence plan

5.8.1 The Evidence Plan process was initially developed by the Major Infrastructure Environment Unit (MIEU) of Department for Environment, Food & Rural Affairs (Defra) to provide a formal mechanism to agree between applicants and statutory bodies what information and evidence an applicant for a Nationally Significant Infrastructure Project (NSIP) should submit in support of an application. The process has been implemented successfully, largely in the offshore wind sector, with some recent examples considering key aspects of EIA as well as HRA.

5.8.2 The A66 NTP project is being developed to an ambitious programme, which aims to optimise the DCO process, ensuring a focus on key issues and requirements, and therefore the Evidence Plan process has been identified as a tool that is potentially useful to aid consultation with key stakeholders and enhance agreements reached at the pre-application process. Engagement between stakeholders and the project is already strong, and therefore the process is seen to be beneficial in guiding and recording the engagement.

5.8.3 Whilst the programme does not allow for the formal process to be applied (and strong ongoing engagement means it is not necessitated), Highways England has decided to adopt the principles of the Evidence Plan process to guide the consultation and development of the EIA and HRA for the A66 NTP, in relation to key areas of legislation and National Policy. The process will be led by the Integrated Project Team (IPT) (Highways England, their delivery partners and advisors) and supported, as appropriate, by PINS. The intention is that this process will inform and feed into the Statements of Common Ground prepared with the SEB and Local Impact Report s prepared by the Local Authorities (LA).

5.8.4 The Evidence Plan is based on the information set out in this ESR regarding baseline information and assessment methodologies and will be a working document developed by the parties involved on an on-going basis up to the point of application. This plan is being developed with the SEB and LAs and informed by wider consultation.

6 Air Quality

6.1 Introduction

6.1.1 This chapter outlines the proposed scope of assessment to be undertaken for air quality.

6.1.2 There may be interrelationships related to the potential effects on air quality and other disciplines. Therefore please also refer to the following documents for further information:

- Chapter 7: Biodiversity
- Chapter 8: Climate

6.1.3 The methodology used will follow the requirements of *Design Manual for Roads and Bridges (DMRB) LA 105 Air Quality* (Highways England, 2019)[31]

6.2 Key questions for scoping

1. Do you agree with the proposed scope of the air quality assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the air quality assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments?
4. Are there any other key issues or aspects relevant to the air quality assessment that you wish to bring to the attention of the design and assessment team?
5. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

6.3 Study area

6.3.1 The study area for the project is determined following the methodology outlined in *DMRB LA 105* and will be defined by the changes in traffic flows on the local road network. *DMRB LA 105* provides guidance on specific changes in traffic flows that are required to trigger an assessment of the project's impacts on air quality.

6.3.2 The project will be assessed on a route wide basis for the purposes of air quality. This is because the data gathered from traffic modelling undertaken as part of the Transport Assessment considers the project as a whole, rather than discrete schemes in isolation.

6.3.3 The following screening criteria, based on *DMRB LA 105*, will be used to determine the extent of the air quality study area on roads within the traffic reliability area (TRA):

- Road alignment changes by 5m or more
- Daily traffic flows change by 1,000 Annual Average Daily Traffic (AADT) flow or more
- Heavy duty vehicle (HDV) flow changes by 200 AADT or more
- A change in speed band

[31] Highways England (2019) Air Quality LA 105, available at: https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90

6.3.4 All roads that trigger the traffic screening criteria, as defined in section 2.1 o*f DMRB LA 105*, and adjoining roads within 200m are defined as the affected road network (ARN). For the purposes of this scoping report, this ARN has been identified based upon the Option Selection stage. This would include consideration of potential diversion routes, as a result of full carriageway closures overnight during the construction phase, for example. This ARN will continue to be reviewed as part of the on-going consideration of the different options discussed in Chapter 2: The Project.

6.4 Overview of consultation to date

6.4.1 Table 6-1 identifies the key comments that have been received to date from external consultees on the scope and approach to the air quality assessment.

Table 6-1: Air quality scope comments to date

Respondent	Comment	How addressed/to the be addressed
Durham County Council (DCC)	The use of detailed dispersion modelling may be appropriate over DMRB screening in areas where potential significant impacts are predicted.	The Atmospheric Dispersion Modelling Software-Roads (ADMS-Roads) dispersion model has been used for the assessment of preliminary design, albeit in a 'simple' method which considers 24 hour AADT rather than the various peak and interpeak periods. This is considered to provide a robust basis for assessment of potential impacts, whilst keeping the assessment proportionate.
	Ensure the assessment process identifies and justifies the selection of an appropriate TRA from the wider traffic model being used, traffic impacts can be felt far and wide and the assessment should consider all links for which there is sufficient confidence in that data (whether then used for screening, simple assessment or detailed assessment).	The TRA for the preliminary design considers a road network far greater than just the A66 between the M6 at Penrith and A1 at Scotch Corner. The potential changes in traffic across the TRA network have been considered and will be assessed in line with *DMRB LA 105*.
	The TRA to include Durham City Air Quality Management Area (AQMA).	The TRA does not extend to Durham City AQMA. The TRA extends to 6km south of the AQMA. However, the nearest ARN link, following screening criteria based on *DMRB LA 105*, is approximately 20km to the south.
	No reference to model verification in scoping report.	Model verification will be undertaken against 2018 nitrogen dioxide (NO_2) monitoring data where located within

Respondent	Comment	How addressed/to the be addressed
		the preliminary design traffic network and considered to be representative.
	Inclusion of particulate matter of 10 micrometres or less (PM_{10}) and 2.5 micrometres or less and ($PM_{2.5}$) in diameter.	Based on the findings of the Option Selection stage *Environmental Assessment Report (EAR)*[32], PM_{10} concentrations are predicted to be well below the Air Quality Objective. Therefore, as per paragraphs 2.21.2 – 2.21.4 in *DMRB LA 105* an assessment of PM_{10} and $PM_{2.5}$ has been screened out.
	It is our opinion that one set of meteorological data cannot be representative of the entire Project area	The sensitivity of alternative meteorological data sites will be considered in the assessment of preliminary design, by means of a qualitative review of alternative site wind roses, to understand the potential effects within ADMS. The use of one meteorological data site is considered to be appropriate for consideration against annual mean averaging periods.

6.5 Baseline conditions

6.5.1 The latest baseline air quality information will be collected, which will include the following:

- Air quality monitoring data within the vicinity of the project which will be obtained from Local Authorities, Department for Environment Food and Rural Affairs (Defra) and/or Highways England.
- Local authority air quality Annual Status Reports (ASRs) including the locations of any AQMA within, or close to the border of the ARN.
- Defra *Background Maps* (Defra, 2019)[33] to collate oxides of nitrogen (NO_X), NO_2 and PM_{10} concentrations
- Background Nitrogen (N) Deposition for designated habitats included in the assessment which will be obtained from Air Pollution Information System website (APIS) (Air Pollution Information System, 2016)[34].
- Location of sensitive receptors (including ecological and human receptors – e.g. residential properties) that could be impacted on by the project.

[32] Highways England (2020) A66 North Trans-Pennine Project Environmental Assessment Report. Document reference: HE565627-ARC-EGN-A66-RP-ZM-1055
[33] Department for Environment, Food & Rural Affairs (2019) Background Mapping data for Local Authorities, available at: https://uk-air.defra.gov.uk/data/laqm-background-home
[34] Air Pollution Information System (2016) Background Nitrogen Depositions, available at: http://www.apis.ac.uk

- Defra information used in its reporting of compliance with the European Union (EU) Directive 2008/50/EC on Ambient Air Quality (European Union, 2008)[35] (which shall include the Pollution Climate Mapping (PCM) Model (Department for Environment, Food & Rural Affairs, 2017)[36] published modelled results).

6.5.2 The project is located in the administrative boundaries of the following local authorities:

- Eden District Council (EDC)
- DCC
- Richmondshire District Council (RDC)

6.5.3 DCC has designated two AQMAs (Durham and Chester-le-Street), however these are located over 30km from the A66, outside of the ARN and are unlikely to be affected by the project. EDC and RDC have not designated any AQMAs. The location of AQMAs can be seen on Figures 6.2 in Chapter 18: Figures.

6.5.4 The Option Selection stage Environmental Assessment Report (EAR) (Highways England, 2018)[37] identified that annual mean NO_2 concentrations in 2017 were below the annual mean objectives within the extent of the ARN. The locations of these monitoring sites are presented in Figures 6.3 in Chapter 18: Figures. The latest local air quality management review and assessment reports will be obtained as part of the baseline assessment, which will include all relevant air quality monitoring data derived from local authority sources. If gaps are identified in the local authority monitoring (e.g. poor data capture) then additional Project-specific monitoring may be required.

6.5.5 In relation to the Defra air quality modelling PCM used to determine compliance with the EU Directive, the nearest PCM links to the project are in Penrith and are well below the annual mean NO_2 EU Limit Value of 40 micrograms per cubic meter of air (µg/m³) (less than 20µg/m³ in 2019).

6.5.6 The predicted Defra background concentrations along the route are well below the annual mean objectives for NO_2 and PM_{10} with maximum NO_2 concentrations of 8.9µg/m³ predicted in Penrith and maximum PM_{10} concentrations of 10.8µg/m³ predicted at the junction with the A1(M).

6.5.7 Although the route is predominantly rural there are pockets of receptors along the A66 which include both residential and ecological receptors. The ecological receptors have been identified within Chapter 7: Biodiversity and are shown on Figures 7.1 in Chapter 18: Figures.

Sensitive Receptors

6.5.8 Receptors that are potentially sensitive to changes in air quality are defined in *DMRB LA 105* as housing, schools, hospitals and designated species or habitats within a designated ecological site, located within 200m of the ARN. All of these such receptors will be treated with an equal level of sensitivity.

6.5.9 Receptors sensitive to potential operational road vehicle exhaust emission impacts adjacent to the ARN were identified during the development of the Option Selection

[35] European Union (2008) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0050&from=en
[36] Department for Environment, Food & Rural Affairs (2017) 2017 NO2 projections data, available at: https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data
[37] Highways England (2018) A66 PCF Stage 1 Environmental Assessment Report

stage *EAR*. These sensitive receptors represent worst-case locations. It is not an exhaustive list and there may be other sensitive receptors that will experience air quality impacts as a result of the project. The receptors chosen as part of the Option Selection stage *EAR* are likely to experience in the greatest changes as a result of the project, based on the change in traffic flows on the roads in close proximity to the receptors.

6.5.10 The compliance risk assessment shall identify areas with qualifying features on the PCM road network that meet Defra's interpretation of the Air Quality Directive. Qualifying features include public access (e.g. footpath) and sensitive receptors (e.g. residential properties, schools and hospitals) within 15m of the kerbside, but are not within 25m of a junction.

6.5.11 The need for additional receptors will be reviewed during the Environmental Impact Assessment (EIA) following screening of the traffic data and calculation of the ARN as part of the assessment of the preliminary design.

6.5.12 46 designated ecological sites have been identified within 200m of the ARN, these include:

- Bowes Moor Site of Special Scientific Interest (SSSI)
- Argill Woods and Pastures SSSI
- Augill Valley Pasture SSSI
- River Eden and Tributaries SSSI / River Eden Special Area of Conservation (SAC)
- Crosby Ravensworth Fell SSSI / Asby Complex SAC
- North Pennine Moors SAC and Special Protection Area (SPA)
- Augill Beck Wood Ancient Woodland Inventory (AWI) site
- Augill Bridge Wood AWI site
- Bessygill Wood AWI site
- Oglebird Plantation AWI site
- Sexton Hagg and Sexton Hagg Extension AWI site
- Newbiggin Wood AWI site
- Graham's Gill / Jack-wood AWI site
- Thorgill Wood AWI site
- Lowhurst Wood AWI site
- Borrowdale Wood AWI site
- Buckholme Wood AWI site
- Cocklet Wood AWI site
- Deep Gill AWI site
- Gill Beck Wood AWI site
- Lowgill Wood AWI site
- Raughtonguill Wood AWI site
- Tees Bank Plantation AWI site
- Warth Wood AWI site
- Waterfall Wood AWI site
- Deepdale Wood AWI site
- Chapel Wood AWI site / Local Wildlife Site (LWS)
- Limekiln Wood AWI / LWS
- Ravensworth Park - Castle Fetch LWS
- Stephen Bank Road Verge LWS
- Pallet Hill LWS
- Sanford Mire LWS

- Disused railway line near Newbiggin LWS
- Catterick Gravel Pits LWS
- Howe Hill Riverside LWS
- The Batts LWS
- Great Bottom Meadow County Wildlife Site (CWS)
- Myers beck CWS
- River Lyvennet Floodplain CWS
- Swindale Woodland CWS
- Morecambe Bay Limestones and Wetlands Nature Improvement Areas (NIA).

6.5.13 Data on ancient woodland and veteran trees have been requested from the Woodland Trust and where features are identified within 200m of the ARN, these will be included.

6.5.14 The preliminary design includes junction improvements at two additional junctions compared to the earlier assessment at Option Selection stage (M6 J40 Penrith and A1(M) J53 Scotch Corner). Any additional ecological sites within 200m of the preliminary design ARN will be identified and included in the assessment during the EIA. ARN will be identified and included in the assessment during the EIA.

6.5.15 Reference should be made to Figures 6.1 to 6.3 in Chapter 18: Figures for details of all the designated ecological sites within 200m of the ARN identified as part of the Options Selection stage *EAR*.

6.6 Potential impacts

Construction

6.6.1 During the construction phase, it is likely there would be additional vehicle movements due to heavy goods vehicles (HGV), non-road mobile machinery, and construction related vehicles accessing construction sites from the surrounding road network, and vehicles on haul roads within the construction site. These activities may result in a temporary increase in emissions associated with Project construction activities.

6.6.2 The impact of construction activities on vehicle movements (including potential diversion routes) shall be considered as part of the EIA to determine the impacts where construction activities are programmed to last for more than two years and where there is an increase of greater than 200 HGV movements per day. Construction traffic information for the preliminary design was not available at the time of writing.

6.6.3 There are also likely to be dust emissions generated through construction activities and HGV movements that maybe controlled through the application of good practice mitigation measures.

Operation

6.6.4 During operation, changes to the road network will result in changes to traffic flow, speed and fleet composition. Traffic flows are likely to increase due to the improved desirability of the route, however speeds are likely to increase due to increased capacity and reduced congestion. These changes will impact on emissions of the main traffic related pollutants, NO_X and PM_{10}. As a result, pollutant concentrations at receptors in the vicinity of the preliminary design, and in the wider study area near the ARN will be affected by the project. These changes may result in permanent

improvements and deteriorations in local air quality. The Option Selection stage *EAR* identified that there are no likely significant impacts.

6.7 Design, mitigation and enhancement measures

6.7.1 Mitigation measures will be required during the construction phase to mitigate dust impacts. Mitigation for traffic impacts during construction and operation will depend on whether the project triggers a significant impact, which is unlikely based on the results presented in the Option Selection stage *EAR*. This will be reviewed and assessed again as part of the EIA.

Construction

6.7.2 Mitigation measures to control dust and traffic emissions will be required during the construction phase.

6.7.3 In relation to construction dust, industrial good practice mitigation measures will ensure that construction dust does not result in a significant impact. These measures will be included in the Environmental Management Plan (EMP) and Traffic Management Plan (TMP) and will be based on the standards in *DMRB LA 105*.

6.7.4 Mitigation measures could include development of a stakeholder communication plan, regular inspections and planning the site layout so that dust causing activities are located as far away as possible from receptors.

6.7.5 In relation to mitigating the impact from construction vehicles, guidance from *DMRB LA 105* will be followed. Measures could include using less polluting construction vehicles such as ensuring that HGVs meet Euro VI emissions standards which reduce NO_X and PM_{10} emissions.

Operation

6.7.6 Should a significant impact be predicted, a Project Air Quality Action Plan (PAQAP) may be required to identify options to reduce the impact associated with the project. Measures are likely to include, for example, adjusting vehicle speeds in areas where receptors are being significantly affected, and will be based on guidance in *DMRB LA 105*.

6.7.7 In addition, the impact on compliance with the EU Directive will need to be assessed in accordance with *DMRB LA 105*. Should the project be assessed as high risk a PAQAP may be required to reduce the project impacts. Whilst the Option Selection stage *EAR* did not predict any significant impacts, this was undertaken in accordance with the previous Interim Advice Note (IAN) 175 guidance and will be confirmed following the updated methodology in *DMRB LA 105*. The principle methodology change is around the need to consider and assess the potential impact of N deposition at all identified ecological receptors. This is different to the approach followed at Option Selection stage where N deposition only needed to be considered when the predicted annual mean NO_X concentrations exceeded the AQO and EU limit value of 30µg/m^3 for the protection of vegetation.

6.8 Description of the likely significant effects

Construction

6.8.1 Residual construction impacts are not considered to be significant as they will be temporary and will be controlled through the EMP.

Operation

6.8.2 The assessment will identify whether the project is likely to result in a significant impact on air quality and whether it is likely to comply with the *National Policy Statement for National Networks (NPSNN)* (Department for Tranport, 2014a)[38]. The following provides a summary of the likely significant effects determined at the Option Selection stage. Further work is being done to understand the likey significant effects associated with the options described in Chapter 2: The Project as part of the scheme development process.

Option Selection – recommended preferred route

6.8.3 Thirty three sensitive receptors (human) and six sensitive receptors (ecological) were modelled as part of the Option Selection stage *EAR* in relation to the recommended preferred route at that time.

6.8.4 The impacts of on local air quality were evaluated by determining the number of worst case receptors likely to result in an improvement or deterioration in air quality and the associated risk of exceeding the annual NO_2 Air Quality Objective (AQO) in a future assessment (acknowledging that this was limited to the information available at the time of assessment).

6.8.5 The modelled results indicate that there were no receptors located along the ARN predicted to exceed the annual mean AQO for NO_2 in the opening year of 2031 (both with and without the proposed route). As such there were not predicted to be any significant air quality effects in accordance with *IAN 174/13* (Highways Agency, 2013a)[39] and IAN 175/13 (Highways Agency, 2013b)[40]. Since the production of the *Option Selection stage EAR*, both the *IAN 174/13* and *IAN 175/13* guidance have been superseded by *DMRB LA 105*. These results will however be confirmed following the updated methodology in *DMRB LA 105.*

6.8.6 The largest changes associated with the recommended preferred route compared to the existing scenario are decreases in NO_2 concentrations predicted at locations along the existing A66 where traffic is diverted onto the new route further away from the receptors in the Kirkby Thore, Ravensworth, Warcop and Brough areas.

6.8.7 Predicted annual mean NO_X concentrations exceeded the AQO and EU limit value of 30µg/m^3 for the protection of vegetation for Bowes Moor SSSI/North Pennine Moors SPA and SAC and Augill Valley Pasture SSSI.

6.8.8 The predicted change in N deposition as a result of the proposed route for Bowes Moor SSSI/North Pennine Moors SPA and SAC was 0.4kgN/ha/yr. The predicted change in N deposition as a result of the proposed route for Augill Valley Pasture SSSI was 0.3kgN/ha/yr. Based on a background N deposition rate for 2015 of 20.7kgN/ha/yr, the lowest increase in N deposition required to reduce measured species richness by one is 1.3kgN/ha/yr. As the change as a result of the proposed

[38] Department for Transport (2014) National Policy Statement for National Networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf
[39] Highways Agency (2013a) Interim Advice Note 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality (HA207/07) available at: http://programmeofficers.co.uk/Preston/CoreDocuments/LCC377.pdf
[40] Highways Agency (2013b) Interim Advice Note 175/13 Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for user of DMRB Volume 11, Section 3, Part 1 'Air Quality, available at: https://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian175.pdf

route at both sites was less than 1.3kgN/ha/yr, the impact of the proposed route on nitrogen deposition was not considered significant. These conclusions have been reviewed in light of the *DMRB LA 105* publication since the completion of the Option Selection stage *EAR* and the findings are considered to remain valid, with no significant impacts on nitrogen deposition predicted. The assessment of ecological sites will be reviewed and updated during the EIA based on the updated traffic flows and road alignment.

6.8.9 The impact of the two additional junction improvements which are being assessed as part of the EIA will be considered in-line with the criteria described in Paragraph 6.3.4 for assessment in the EIA.

6.9 Assessment methodology

Construction

6.9.1 At the time of writing there is limited information available about construction dust generating activities and construction traffic volumes. When construction related information is available it will be reviewed following the guidance in *DMRB LA 105*.

6.9.2 The impact of construction activities on vehicle movements shall be considered and assessed using the traffic screening criteria set out in Paragraph 6.3.3, where activities are programmed to last for more than two years. If vehicle movements exceed the screening criteria then a simple assessment will be carried out in line with the standards in *DMRB LA 105*.

6.9.3 Information relating to dust generating activities which may have an impact on local air quality, such as data about construction, demolition and earthwork activities from the project, will be reviewed. Information will also be collected relating to trackout of material onto local roads where it can be re-suspended, as this may also affect air quality. Trackout refers to the transport of dust and PM_{10} from construction areas onto the road network.

Operation

6.9.4 The air quality assessment will be proportionate to the stage to identify whether there is any risk that the project could lead to a significant impact on air quality.

6.9.5 A detailed level of assessment is more likely at the detailed design stage of the project lifecycle. The need for this level of assessment is determined by considering the project's risk potential, i.e. its potential to have impact on traffic, and the sensitivity of the receiving environment.

6.9.6 The risk potential of the project is classed as high as it is a large project involving dualling sections of the A66, construction of five off-line alignments together with five junction improvement schemes and modification of the roundabout at Kemplay Bank.

6.9.7 The sensitivity of the receiving environment is medium as there are receptors (human and ecological) within 50m of the roads triggering the traffic change criteria, given in section 2.1 of *DMRB LA 105*. The ecological receptors include 5 SSSIs (Argill Woods and Pastures, Augill Valley Pasture, Bowes Moor, Crosby Ravensworth Fell and River Eden and Tributaries SSSIs) and 3 SACs (Asby Complex, North Pennine and River Eden SACs).

6.9.8 Based on the flowchart given in Figure 2.10 of *DMRB LA 105*, and by combining the project's risk potential and sensitivity of the receiving environment, a detailed assessment will be required as part of the EIA.

6.9.9 The assessment will focus on reviewing updated traffic data to identify areas of change, and then will use an air dispersion model (ADMS-Roads v5.0.0.1) to identify any areas at risk of exceeding the AQO.

6.9.10 The assessment will be undertaken for the baseline, Do-Minimum (DM) 'without Project' scenario in the Opening Year (OY) and the Do-Something (DS) 'with Project' scenario in the OY. For local air quality, the opening year of the project is likely to be the worst-case scenario as vehicle emissions and background pollutant concentrations are anticipated to decrease over time due to improvements in fuel technologies.

6.9.11 Evidence from monitoring across the UK has indicated concentrations of pollutants are not reducing as quickly as predicted by Defra despite improvements to engine technology (Highways Agency, 2013c)[41]. To account for this, the future baseline projections scenarios will also be calculated for the OY following the methodology in section 2.47 of *DMRB LA 105*.

6.9.12 Traffic data will be provided for the air quality assessment by the project transport team. Traffic data will be provided representing the average conditions occurring in four specific time periods (AM peak, inter-peak, PM peak and off peak). For the time periods in Table 6-2, the following data parameters will be provided:

- Traffic flow, defined as vehicles/hour
- Percentage HDV
- Vehicle speeds, in kilometres per hour (km/hr)
- Speed band information for use in calculation of emission factors in accordance with *DMRB LA 105*.

Table 6-2: Traffic Time Periods

Traffic period	Time period
AM peak (AM)	3 hours (07.00-10.00)
Inter-peak (IP)	6 hours (10.00-16.00)
PM peak (PM)	3 hours (16.00-19.00)
Off peak (OP)	12 hours (19.00-07.00)

6.9.13 The air quality assessment will use data provided from the traffic model for the future years which includes future committed developments.

6.9.14 Emissions from traffic data will be calculated using the emission factors provided in the latest version of the Highways England speed band emissions factors spreadsheet.

6.9.15 The Geographic Information System (GIS) software, ArcMap, will be used to assist in inputting the road link information into the air quality model. The ADMS-Roads model (v5.0.0.1) developed by Cambridge Environmental Research Consultants Ltd will be used for the areas of the ARN where a detailed assessment approach will be followed.

6.9.16 The resultant predictions at sensitive receptors will be compared to the AQO and significance will be defined as per *DMRB LA 105*. Professional judgement will be applied alongside the application of GIS tools to identify these sensitive receptors.

[41] Highways Agency (2013c) Note on HA's Interim Alternative Long-Term Annual Projection Factors (LTT_{E6}) for Annual Mean NO_2 and NO_x Concentrations Between 2008 and 2030. Department for Transport.

6.9.17 Committed developments (see Chapter 16: Assessment of Cumulative Effects) where the approved use is sensitive to air quality impacts (e.g. residential properties, schools, hospitals, care homes), will also be considered in the air quality assessment as potential future receptors. Additional vehicle trip generation figures as a result of committed developments are also included within the traffic data provided for the future baseline scenario for the Project. Please refer to the Transport Assessment for further details.

6.9.18 To aid the interpretation of significance of public exposure, as a result of the project, Table 2.92N in *DMRB LA 105* provides the criteria which will be used in this assessment. At a sensitive receptor location, if a concentration is greater than the AQO and the project is predicted to have a greater than 1% change (compared with the relevant objective, e.g. 0.4µg/m^3 for annual mean NO_2), then the results will be assigned to the change criteria shown in Table 6-3.

6.9.19 Where predicted annual mean NO_2 concentrations are below the AQO or the magnitude of change is ≤0.4µg/m^3, effects are likely to be imperceptible.

Table 6-3: Guideline for number of properties constituting a significant effect

Magnitude of change in NO_2 (µg/m^3)	Number of receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large (>4)	1-10	1-10
Medium (>2 - 4)	10-30	10-30
Small (≤0.4 - 2)	30-60	30-60

6.9.20 As per *DMRB LA 105*, an assessment of the risk of the project resulting in an exceedance of the NO_2 limit value and being non-compliant with the EU Directive on Ambient Air Quality will be undertaken.

6.9.21 The impacts of the project (i.e. the change in concentrations predicted by the ADMS-Roads model) will be added to the modelled concentrations from the Defra PCM model for the opening year of the project. To determine the compliance risk of the project, the Compliance Risk Flow Chart in Figure 2.79 in *DMRB LA 105* will be followed.

6.9.22 In terms of ecological sites, the sites located within 200m of the ARN will be identified and nitrogen deposition will be calculated for comparison against the critical loads for the habitat.

6.9.23 Determining the significance of the potential changes to nitrogen deposition requires habitat specific advice from the Biodiversity team. Once the predicted changes in pollutant concentrations and deposition rates are available, the Biodiversity team will be consulted to jointly consider and assess the potential impacts predicted at the ecological designations. The ultimate decision on potential impacts however will be based on the judgement of the Biodiversity team.

6.9.24 The assessment approach proposed will determine whether the project is likely to comply with the *NPSNN* and in particular paragraphs 5.12 and 5.13 which provides the advice to the decision maker which should be used when determining whether a Project should receive consent:

5.12 The Secretary of State must give air quality considerations substantial weight where, after taking into account mitigation, a project would lead to a significant air quality impact in relation to EIA and / or where they lead to a deterioration in air quality in a zone / agglomeration." (see paragraph 6.9.18 and 6.9.22)

5.13 The Secretary of State should refuse consent where, after taking into account mitigation, the air quality impacts of the scheme will: result in a zone / agglomeration which is currently reported as being compliant with the Air Quality Directive becoming non-compliant; or affect the ability of a non-compliant area to achieve compliance within the most recent timescales reported to the European Commission at the time of the decision." (see paragraph 6.9.20 and 6.9.21)

6.9.25 A summary of the results and compliance will be provided in the section of the ES titled 'Assessment of likely significant effects'.

6.10 Assessment assumptions and limitations

6.10.1 The assessment will be proportionate and will utilise the traffic data available at the time of the assessment.

6.10.2 At ES stage, traffic data will be assessed for the DS scenario associated with the preliminary design, for comparison with the DM scenario.

6.10.3 Air quality dispersion modelling has inherent areas of uncertainty, including:

- The traffic data used in the model
- The traffic emissions data
- Simplifications in model algorithms and empirical relationships that are used to simulate complex physical and chemical processes in the atmosphere
- The background concentrations
- The meteorological data

6.10.4 Sensitivity testing of emissions data will be carried out using the most recent methodology from *DMRB LA 105* by including a projected baseline scenario. This will reduce uncertainty, ensuring that the modelled roadside NO_2 concentrations are not too optimistic by adjusting the *concentrations in-line with observed monitoring trends using the (then) Highways Agency Interim Alternative Long Term Annual Projection Factors (LTTE6)*.

6.10.5 Uncertainties or limitations related to transport data will be discussed in the Transport Assessment and Combined Modelling and Appraisal Report for the Project. These limitations will be minimised as far as possible by verifying the modelled concentrations against monitoring results in appropriate locations.

6.10.6 The methodology used in this assessment is designed to provide a robust assessment, reducing uncertainty caused by the above limitations.

6.10.7 The transport consultant for the scheme has confirmed that with regard to the impact of Covid on the baseline, any traffic count data collected post March 2020 would not be considered to be representative of typical conditions and have assumed that traffic distribution patterns from the 2015 mobile network data (growthed to 2019) are representative.

6.10.8 The project has followed advice from DfT's 2020 guidance *'A route map for updating TAG during uncertain times'*, together with the growth revisions from the Office for Budget Responsibility (OBR), which represent a significant reduction in growth compared to any previous OBR update. The February 2021 appraisal update has yet to be issued, as such the advice within the July 2020 document will continue to

be followed until further notice. It is anticipated that the traffic data provided for the ES will be based on the guidance within the February 2021 appraisal update. For more information, see the Transport Assessment for the Project.

Table 6-4: Air Quality scoping criteria from *DMRB LA 105* - construction

Based on the changes between the do something traffic (with the project) compared to the do minimum traffic (without the project) in the opening year:	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) annual average daily traffic (AADT) >=1,000; or	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
2) heavy duty vehicle (HDV) AADT >=200; or	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
3) a change in speed band; or	N	N	N	N	N	N	N	N	N	N
4) a change in carriageway alignment by >=5m.	N	N	N	N	N	N	N	N	N	N
Key Mitigation	-	-	-	-	-	-	-	-	-	Potential measures will be included in the EMP and TMP and will be based on the standards in *DMRB LA 105*.
Proposed Scope (In)	-	-	-	-	-	-	-	-	-	At the time of writing there is limited specific information available about construction dust generating activities and construction traffic volumes. When construction information is available it will be reviewed following the guidance in *DMRB LA 105* and screened into the assessment if required. Construction details will also be provided and reviewed to inform qualitative assessment as part of the EIA for all relevant worksites, where available. The impact of construction activities on vehicle movements shall be assessed as part of the EIA to determine the impacts where construction activities are programmed to last for more than two years and where there is an increase of greater than 200 HGV movements per day. This will be considered on a route-wide basis.
Proposed Scope (Out)	-	-	-	-	-	-	-	-	-	Nothing is proposed to be scoped out for air quality at this stage.

Table 6-5: Air Quality scoping criteria from *DMRB LA 105* - operation

Based on the changes between the do something traffic (with the project) compared to the do minimum traffic (without the project) in the opening year:	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) annual average daily traffic (AADT) >=1,000; or	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2) heavy duty vehicle (HDV) AADT >=200; or	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3) a change in speed band; or	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
4) a change in carriageway alignment by >=5m.	TBC	Y	Y	Y	Y	Y	Y	Y	TBC	Y
Key Mitigation	-	-	-	-	-	-	-	-	-	Should a significant impact be predicted a PAQAP may be required to identify options to reduce the impact associated with the project. Measures are likely to include for example, limiting vehicle speed in traffic in areas where receptors are being significantly affected, and will be based on guidance in *DMRB LA 105*.
Proposed Scope (In)	-	-	-	-	-	-	-	-	-	During operation, changes to the A66 will result in changes to traffic flow, speed and fleet composition across a wide network adjacent to the A66 and beyond. Traffic flows are likely to increase due to the improved desirability of the route, however speeds are likely to increase due to increased capacity and reduced congestion. These changes will impact on emissions of the main traffic related pollutants, oxides of nitrogen (NO_X) and PM_{10}. As a result, pollutant concentrations at receptors in the vicinity of the project, and in the wider study area near the ARN will be affected by the project. This will be considered on a routewide basis.
Proposed Scope (Out)	-	-	-	-	-	-	-	-	-	Nothing is proposed to be scoped out for air quality at this stage.

7 Biodiversity

7.1 Introduction

7.1.1 This chapter outlines the proposed scope of assessment to be undertaken for biodiversity.

7.1.2 There may be interrelationships related to the potential effects on biodiversity and other disciplines. Therefore, please also refer to the following chapters:

- Chapter 6: Air Quality
- Chapter 8: Climate
- Chapter 10: Geology and Soils
- Chapter 11: Landscape and Visual
- Chapter 13: Noise and Vibration
- Chapter 15: Road Drainage and the Water Environment

7.1.3 The methodology used will follow the requirements of *DMRB LA 108 Biodiversity* (Highways England, 2020a)[42], *LD 118 Biodiversity Design* (Highways England, 2020b)[43], and CIEEM *Guidelines for Ecological Impact Assessment in the UK and Ireland* (Chartered Institute of Ecology and Environmental, 2018)[44].

7.2 Key questions for scoping

1. Do you agree with the proposed scope of the biodiversity assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the biodiversity assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments that you have not already provided?
4. Are there any other key issues or aspects relevant to the biodviersity assessment that you wish to bring to the attention of the design and assessment team?
5. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

7.3 Study area

7.3.1 Baseline data collection was undertaken, at various scales, up to an approximate 30km radius from the A66 and the locations where options could be developed at Option Selection stage. This baseline data is in the process of being updated and refined to inform the EIA to ensure the validity and relevance of the data available. The biodiversity study area is defined in accordance with *DMRB LA 108 Biodiversity*,

[42] Highways England (2020a) Biodiversity LA 108, available at: https://www.standardsforhighways.co.uk/dmrb/search/af0517ba-14d2-4a52-aa6d-1b21ba05b465
[43] Highways England (2020b) Biodiversity design LD 118, available at: https://www.standardsforhighways.co.uk/dmrb/search/9317652b-4cb8-4aaf-be57-b96d324c8965
[44] Chartered Institute of Ecology and Environmental (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.

LD 118 Biodiversity Design, and CIEEM *Guidelines for Ecological Impact Assessment in the UK and Ireland*. The study area has been identified and will be reported, based on the:

- Project boundary including any off-site ancillary works or areas.
- Construction footprint, including potential construction compounds, haul routes, borrow pits and temporary land take.
- Project's zone of influence on biodiversity resource.

7.3.2 In line with this guidance, the zone of influence of the project and the distance within which ecological features could be significantly affected varies, to encompass all potential significant effects.

Desk study

7.3.3 The area for the ecological desk study undertaken at Option Selection stage and how this is being updated to inform the EIA, is provided in Table 7-1.

Table 7-1: Desk study search radii

Receptor	Search radius at Option Selection Stage	Search radius for updates for EIA
Internationally important sites of nature conservation importance	2km (or 30km for Special Areas of Conservation (SAC) where bats are noted as one of the qualifying interests)	2km (or 30km for Special Areas of Conservation (SAC) where bats are noted as one of the qualifying interests)
Nationally designated sites for nature conservation importance	2km	2km
Regionally important and local non-statutory designated sites	1km	2km
Protected/notable species	1km	2km
Section 41 Habitats of Principal Importance, Ancient Woodland (AWI) sites and veteran trees.	1km	1km

7.3.4 Additionally, any other sites where a potential effect pathway exists will be included regardless of distance. For example this may include where a site is considered to be hydrologically linked or where there may be changes in air quality and noise due to increased traffic volume on the road. In particular this may relate to watercourses and crossings, e.g. works that may change the functioning of a watercourse, and hence change the distribution and quality of habitats downstream.

7.3.5 In relation to air quality, in accordance with *DMRB LA 105 Air Quality* (Highways England, 2019)[45], the selection of sensitive receptors to be included within the air quality assessent includes any designated habitats (Ramsar sites, Special Protection Areas (SPA), SAC, Sites of Special Scientific Interest (SSSI), Local Nature Reserves (LNR), Local Wildlife Sites (LWS), Nature Improvement Areas, ancient woodland and

[45] Highways England (2019) Air Quality LA 105, available at: https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90

veteran trees) within 200m of the Affected Road Network (ARN) (refer to Chapter 6: Air Quality).

7.3.6 The desktop assessment will incorporate the use of Ordnance Survey (OS) mapping and aerial imagery to identify key habitats and areas for field survey.

7.3.7 Records obtained at Option Selection stage that will be reviewed and updated for the EIA include freely available data from from the Multi-Agency Geographic Information for the Countryside (MAGIC) website (Multi-Agency Geographic Information for the Countryside, 2020)[46], *Natural England Open Data* (Natural England, 2020)[47] and the *National Biodiversity Network (NBN) Atlas* (National Biodiversity Network, 2020)[48]. In addition, records from database searches with relevant statutory and non-statutory consultees will be reviewed and updated where required. This includes the Environment Agency (EA), Cumbria Biodiversity Data Centre (CBDC), Woodland Trust, Environmental Records Information Centre North East (ERICNE), North & East Yorkshire Ecological Data centre (NEYEDC), Highways England, and local groups or recorders (e.g. badger, red squirrel, ornithology, invertebrates, amphibians and reptiles).

Field surveys previously completed at Option Selection stage

Phase 1 Habitat survey – Temple Sowerby to Appleby only

7.3.8 Phase 1 Habitat survey within 500m of the land required for construction was undertaken at the Temple Sowerby to Appleby scheme (previously known as Section 6) only at Option Selection stage. The options assessed in these locations (Options E and F) crossed Trout Beck which forms part of the River Eden SAC and River Eden and Tributaries SSSI. In addition, Options G and H were located adjacent to woodland which were highlighted as potentially being used by otter (Lutra lutra), one of the primary reasons for selection of the SAC.

7.3.9 The level of field survey undertaken was zoned according to likely impacts. Within 100m of the route, extended Phase 1 Habitat survey (Preliminary Ecological Appraisal) was undertaken from Public Rights of Way only. Within 101 to 250m, only broad habitat types with target notes of any features of interest were recorded. Within 251 to 500m the habitats were mapped from aerial photography provided by drone footage. Habitat Suitability Index (HSI) assessments, as developed by *Oldham et al*. (Oldham et al., 2000)[49], were completed on waterbodies within the 500m buffer survey area of the Temple Sowerby to Appleby scheme. These assessments were completed from Public Rights of Way only, therefore not all waterbodies within this area were accessed.

River Eden SAC survey

7.3.10 The Option Selection stage assessment focused on the River Eden SAC only, since the project crossed the designated site, and included a survey of all areas of the SAC that are crossed by the the project and tributaries of the SAC that are to be lost/culverted/diverted or may potentially experience a significant change in water quality or quantity that could affect the flora and fauna within the watercourse and/or

[46] Multi-Agency Geographic Information for the Countryside (2020) Interactive Map, available at: https://magic.defra.gov.uk/magicmap.aspx
[47] Natural England (2020) Natural England Open Data Geoportal, available at: https://naturalengland-defra.opendata.arcgis.com/
[48] National Biodiversity Network (2020) Atlas, available at: https://nbnatlas.org/
[49] Oldham, R.S., Keeble, J., Swan, M.J. and Jeffcote, M. (2000). Evaluating the suitability of habitats for great crested newt (Triturus cristatus). Herpetological Journal 10: 143-15.

the SAC. A total of 12 x 500m lengths were surveyed from three river corridors: the River Eden, Trout Beck and Keld Sike. For SAC crossing points, as a minimum, the study area included the area of the watercourse within the construction footprint of the proposed route option and a 1km buffer around it. Tributaries were only surveyed where the potentially affected areas were situated within 500m of the SAC; the study area included the area of the watercourse within the construction footprint of the proposed route option and a 500m buffer around it. The survey encompassed the two areas of Trout Beck (crossed by Option E and F) and after implementing a combination of survey methodologies, 12 survey areas of both the River Eden and Trout Beck were assessed. For the purposes of the Option Selection stage assessment, a bespoke survey approach combining River Habitat Survey (RHS), River Corridor Survey (RCS) and geomorphological methodologies was undertaken. In addition, the survey documented all features within the study area that were suitable for supporting the species associated with the River Eden and Tributaries SSSI (i.e. sand banks suitable for sand martin and river shingles and sandbanks suitable for invertebrates).

Breeding bird survey – Appleby to Brough (Warcop) and Bowes Bypass (A66/A67) only

7.3.11 Breeding bird surveys were undertaken at Option Selection stage for Appleby to Brough (Warcop) and Bowes Bypass (A66/A67) schemes only (previously Options I and J). The surveys were undertaken due to the potential for the project to impact on the qualifying features of the North Pennines Moors Special Protection Area (SPA), in particular hen harrier (Circus cyaneus), merlin (Falco columbarius), peregrine falcon (Falco peregrinus), and European golden plover (Pluvialis apricaria). Five transect routes were identified: four at Appleby to Brough (Warcop) and one at Bowes Bypass (A66/A67). The survey area comprised the land required for the construction of the project and a 500m buffer either side. The transect routes therefore included land which may be impacted by the project in order to identify if it is used qualifying species of the SPA and therefore may be functionally linked to the SPA.

Proposed study area for EIA

7.3.12 The initial study area for field surveys to inform the EIA will incorporate the indicative Development Consent Order (DCO) boundary of each scheme and up to 250m for detailed surveys including Preliminary Ecological Appraisal (PEA) incorporating Phase 1 Habitat Survey. Following the initial PEA surveys, further surveys will be undertaken as part of the EIA in line with current guidance for the receptors concerned. Where necessary the study area will be extended or surveys for additional ecological receptors not previously identifed at Option Selection stage will be undertaken as a result of the initial PEA undertaken at each Scheme. This may be required in order to incoporate all areas where significant effects could occur on the biodiversity resource throughout the lifecycle of the project. Opportunities to work with Natural England, the Environment Agency, local record centres and local study interest groups will be explored in order to gather existing data related to habitats and species at the study area.

7.4 Overview of Consultation to Date

7.4.1 Table 7-2 identifies the key comments that have been received to date from external consultees on the scope and approach to the biodiversity assessment.

Table 7-2: Biodiversity Scope Comments to Date

Respondent	Comment	How addressed/to be addressed
Natural England, email dated 16 November 2020	Detailed breeding and wintering bird surveys will be required.	Breeding and wintering bird surveys are being undertaken up to 500m from each scheme.
Natural England, email dated 16 November 2020	Refer to Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the *Habitats Regulations* (Natural England, 2018)[50]	Noted. Document will be used to assist in informing assessment relating to road traffic emissions on sensitive habitats and designated sites.
Environment Agency, Consultation Response to previous informal scoping, dated 18 December 2020	Where species data unavailable for watercourses it should be assumed that migratory fish (e.g. salmon, sea trout, lamprey, eels) are present upstream of the scheme unless survey information demonstrates otherwise, or there is no suitable habitat. Assumed presence approach should also apply to white-clawed crayfish and otters. Cumbria Biodiversity Data Centre at Tullie House may hold some records and the Environment Agency or local Highways England section may hold data on otter road deaths.	Detailed surveys for otter, fish and white-clawed crayfish will be undertaken in order to confirm presence or likely absence. Records from CBDC, Environment Agency and Highways England have been requested/obtained.
Environment Agency, Consultation Response to previous informal scoping, dated 18 December 2020	River Greta Fish Passage improvements: projects proposed to improve fish passage throughout Tees catchment, including the Gills to Gill Beck Project led by Tees Rivers Trust. Environment Agency also proposing to enhance fish passage at River Greta Rutherford Bridge gauging station.	To be considered in relation to enhancements and potential for Highways England Environment Designated Funds (EDF). Opportunities to work with existing groups and projects will be explored.
Environment Agency, Consultation Response to previous informal	Method suggested to not undertake white-clawed crayfish surveys where signal records are present should only be followed where records of signal crayfish are confirmed, and populations appear well established.	Proposals for white-clawed crayfish have been updated since informal scoping. Otter surveys being undertaken in 2021. Full

[50] Natural England (2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations, available at: http://publications.naturalengland.org.uk/publication/4720542048845824

Respondent	Comment	How addressed/to be addressed
scoping, dated 18 December 2020	Records indicate otters are in the wider area and the potential impacts and potential for greater road mortality during operation should be fully assessed and mitigated. Various environmental partnerships such as the North Pennines AONB Partnership and the Your Tees Catchment Partnership may be able to help inform mitigation proposals.	consideration of potential impacts and mitigation including maintenance of passage and avoidance of road mortality is being undertaken as part of the assessment and fed into the design of the project. Opportunities to work with existing groups and projects will be explored.
Environment Agency, Consultation Response to previous informal scoping, dated 18 December 2020	Timings and method of any work to be agreed in order to minimise fisheries impacts. Existing Highways England A66 Tutta Beck culvert is sub-optimal for fish passage in all conditions. Structure was not included in a previous improvement study as it would likely be addressed by the A66 Major Project. Highways England should carry out feasibility of fish pass improvements at this asset and retrofit enhancements to the satisfaction of the Environment Agency. A tributary (Smallways) flow under a current dualled length that requires fish passage improvements just upstream of the A66.	Maintenance of fish passage is being incorporated into design of new watercourse crossings as part of the embedded mitigation for the project. Further consideration is required relating to the existing locations noted by the Environment Agency and the potential for these to form Highways England EDF applications.
Environment Agency, – Consultation Response to previous informal scoping, dated 18/12/2020	We suggest the use of the Defra Metric 2.0 (or subsequent versions) to calculate the initial baseline and identify ongoing and changing options for mitigation/replacement habitat. Along with the use of the Metric 2.0, a Landscape and Ecological Management Plan (LEMP) could also be used to set out the actions required to achieve and maintain the biodiversity value of each scheme for the site. All habitats whose value is contributing to the overall biodiversity value of the scheme could be detailed in the LEMP, including any habitats which are to be maintained in their pre-development state.	The Defra biodiversity Metric 2.0 (or subsequent versions) will be utilised for the project. Details of post-development habitat creation and management within a document such as a LEMP will support this.

Respondent	Comment	How addressed/to be addressed
Environment Agency, – Consultation Response to previous informal scoping, dated 18 December 2020	The Project should set an ambitious biodiversity net gain percentage and secure appropriate land to achieve its secure attainment of this net gain target. A target of no net loss seems inappropriate given the uncertainties that may arise through the accelerated programming approach. Although NSIPs will be exempt from the 10% BNG target in the upcoming Environment Bill, we would welcome Highways England, as a Government agency, leading by example and committing to the delivery of ambitious biodiversity net gain for the project.	Noted – targets for the project are in discussion and the project will seek to maximise biodiversity delivery. Potential EDF applications and landowner agreements will be explored. Methods for delivering potential enhancements through agreement or other means are being explored.
Natural England, comments on the draft A66 NSIP scoping document 09 December 2020	River Eden SAC is designated for its Rivers with floating vegetation often dominated by water-crowfoot. This is the River Eden river habitat and is present throughout thought the whole length of the SAC (except for Ullswater) and hence is present in the study area. The impact on this habitat needs to be assessed in many of the scheme areas, but in particular Schemes 4 & 5. The notified SSSI river feature (which is the same as the SAC feature) is Flowing Waters - Type VI: base-rich, mesotrophic rivers in western and northern Britain, with a moderate to fast current.	Noted – all elements and supporting functions are to be considered and addressed in the detailed assessment and HRA.

7.5 Baseline conditions

7.5.1 The A66 between the A1(M) at Scotch Corner and the M6 at Penrith runs through predominantly agricultural land comprising arable and grazed grassland fields with boundary hedgerows, drainage ditches and ponds. The River Eden and associated riparian habitats run in close proximity to the A66 between Penrith and the western edge of the Pennines. Along the A66 corridor, there are also small pockets of woodland and built-up areas. In the central part of the route the A66 crosses the Pennines which contain extensive areas of blanket bog, moorland and heathland.

Desk study

Statutory designated sites

7.5.2 There are four SACs, one SPA and one Local Nature Reserve (LNR) within the 2km biodiversity study area (Table 7-4). There are no SACs designated for bats within

30km of the project. There are nine SSSIs, approximately 65 veteran trees and over 30 ancient woodland sites within the study area (Table 7-3).

7.5.3 There is an additional SAC (Asby Complex) and three SSSIs (Argill Woods and Pastures, Augill Valley Pasture and Crosby Ravensworth Fell), which are situated within 200m of the Affected Road Network (ARN).

7.5.4 There are no statututory deisgnated sites within the study areas of Stephen Bank to Carkin Moor or A1(M) J53 Scotch Corner.

7.5.5 There are no National Nature Reserves (NNR), Royal Society for the Protection of Birds (RSPB) Reserves or Ramsar Sites within the study area.

7.5.6 Details of the statutory designated sites within the 2km study area and within 200m of the ARN are provided in Table 7-3 and in Figure 7.1 in Chapter 18: Figures. With regards to SACs, the Habitats Directive (which continues to have effect post-Brexit in UK law as a result of the Habitats Regulations) requires the UK Government to specify areas to ensure the conservation of flora and fauna species. Annex I of the Habitats Directive covers the habitats and Annex II the species which require designation of Special Areas of Conservation.

Table 7-3: Statutory designated sites within the biodiversity study area. Annex I priority habitats are denoted by an asterisk (*)

Site	Reason for designation	Approximate location to schemes (within 2km)
River Eden SAC	River Eden SAC is designated for its Rivers with floating vegetation often dominated by water-crowfoot. This is the River Eden river habitat and is present thought the whole length of the SAC (except for Ullswater) and hence is present in the study area. <u>Annex I habitats that are a primary reason for selection of this site:</u> Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea (refers to Ullswater which is outside of the biodiversity study area). • Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation. • Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) * <u>Annex II species that are a primary reason for selection of this site:</u> • Atlantic salmon (*Salmo salar*) • Brook lamprey (*Lampetra planeri*) • Bullhead (*Cottus gobio*) • Otter (*Lutra lutra*) • River lamprey (*Lampetra fluviatilis*) • Sea lamprey (*Petromyzon marinus*)	M6 Junction 40 – Adjacent M6 Junction 40 to Kemplay Bank Roundabout – Adjacent Penrith to Temple Sowerby (Center Parcs) – Adjacent Temple Sowerby to Appleby – Within Appleby to Brough (Warcop) – 0.6 km south-west

Site	Reason for designation	Approximate location to schemes (within 2km)
	• White-clawed crayfish (*Austropotamobius pallipes*)	
Helbeck and Swindale Woods SAC	<u>Annex I habitats that are a primary reason for selection of this site:</u> • Tilio-Acerion forests of slopes, screes and ravines (mixed woodland on base-rich soils associated with rocky slopes) *	Appleby to Brough (Warcop) – 0.5 km north
Moor House-Upper Teesdale SAC	<u>Qualifying habitats: the site hosts the following habitats listed in Annex I:</u> • Alkaline fens • Alpine and boreal heaths (alpine and subalpine heaths) • Alpine pioneer formations of the Caricion bicoloris-atrofuscae (high-altitude plant communities associated with areas of water seepage) * • Blanket bogs* • Calaminarian grasslands of the Violetalia calaminariae (grasslands on soils rich in heavy metals) • Calcareous and calcshist *screes* of the montane to alpine levels Thlaspietea rotundifolii (base-rich scree) • *Calcareous* rocky slopes with chasmophytic vegetation (plants in crevices in base-rich rocks) • European dry heaths • Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. (calcium-rich nutrient-poor lakes, lochs and pools) • Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (tall herb communities) Juniperus communis formations on heaths or calcareous grasslands (juniper on heaths or calcareous grasslands) • Limestone pavements* • Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (purple moor-grass meadows) • Mountain hay meadows	Appleby to Brough (Warcop) – 1.1 km north

Site	Reason for designation	Approximate location to schemes (within 2km)
	• Petrifying springs with tufa formation (*Cratoneurion*) hard-water springs depositing lime* • Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*) (dry grasslands and scrublands on chalk or limestone) • Siliceous alpine and boreal grasslands (montane acid grasslands) • Siliceous rocky slopes with chasmophytic vegetation (plants in crevices on acid rocks) • Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) <u>Qualifying species:</u> • Round-mouthed whorl snail (*Vertigo genesii*) • Marsh saxifrage (*Saxifraga hirculus*)	
North Pennines Moors SAC	<u>Qualifying habitats: the site hosts the following habitats listed in Annex I:</u> • European dry heaths • Juniperus communis formations on heaths or calcareous grasslands • Blanket bogs (* if active bog) • Petrifying springs with tufa formation (*Cratoneurion*) * • Siliceous rocky slopes with chasmophytic vegetation • Old sessile oak woods with Ilex and Blechnum in the British Isles • Northern Atlantic wet heaths with Erica tetralix • Calaminarian grasslands of the Violetalia calaminariae • Siliceous alpine and boreal grasslands • Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites) • Alkaline fens • Siliceous scree of the montane to snow levels Androsacetalia alpinae and Galeopsietalia ladani • Calcareous rocky slopes with chasmophytic vegetation	Bowes Bypass (A66/A67) – 0.3 km north

Site	Reason for designation	Approximate location to schemes (within 2km)
	Qualifying species: • Marsh saxifrage (*Saxifraga hiruculus*)	
Asby Complex SAC	Qualifying habitats: • Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) • Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) • Petrifying springs with tufa formation (*Cratoneurion*) * • Alkaline fens • Limestone pavements * • Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. • European dry heaths • Calcareous fens with Cladium mariscus and species of the Caricion davallianae * Qualifying species: • Geyer's whorl snail (*Vertigo geyeri*) • Slender green feather-moss *(Drepanocladus (Hamatocaulis) vernicosus)*	Adjacent to M6 (ARN)
North Pennine Moors Special Protection Area (SPA)	Includes parts of the Pennine moorland massif between the Tyne Gap (Hexham) and the Ribble-Aire corridor (Skipton). Encompasses extensive tracts of semi-natural moorland habitats including upland heath and blanket bog. Qualifying species: • Golden plover (*Pluvialis apricaria*) • Hen harrier (*Circus cyaneus*) • Merlin (*Falco columbarius*) • Peregrine (*Falco peregrinus*) Non-qualifying species of interest: • Montagu's harrier (*Circus pygargus*) • Short-eared owl (*Asio flammeus*)	Appleby to Brough (Warcop) – 1.2 km north Bowes Bypass (A66/A67) – 0.3 km north
River Eden and Tributaries SSSI	Outstanding floristically rich, northern river on sandstone and hard limestone. The diversity of aquatic plants is amongst the highest of all rivers in Britain. The aquatic flora includes uncommon species and those at the geographical limit of their British distribution. The notified SSSI river feature (which is the same as the SAC feature) is rivers with floating vegetation often dominated by water-	M6 Junction 40 – Adjacent M6 Junction 40 to Kemplay Bank

Site	Reason for designation	Approximate location to schemes (within 2km)
	crowfoot/flowing waters - Type VI: base-rich, mesotrophic rivers in western and northern Britain, with a moderate to fast current. Some of the headwaters of the Eden comprise one of the most important British sites for the native white-clawed crayfish. Stream systems on the Eden which support native crayfish include the River Eamont and there are also crayfish in the main channel of the Eden between Temple Sowerby and Kirkby Stephen. Ullswater at the head of the River Eamont supports a large population of schelly (*Coregonus lavaretus*), although this is outside of the biodiversity study area for this project. The river is also of high invertebrate interest for species associated with river shingles and sandbanks. Of particular interest are the shore bug (*Sadula fucicola*), and the leaf beetle (*Hydrothassa hannoverianna*), both of which are nationally rare. Six nationally scarce species have also been recorded, including the ground beetles Bembidian schuepelli, and B. fluviatile; found on sand by northern rivers, and Asaphidian pallipes. The flies Loncoptera meijeri, Camspicnemus marginatus, and Rhaphium fractrum, found at the edge of the Eden, are also nationally scarce. The fish fauna includes Atlantic salmon, bullhead and all three species of lamprey found in British rivers. The Eden supports a high diversity of breeding birds associated with riparian habitats. The sand martins (Riparia riparia), nesting in the riverbanks collectively comprise the largest colony in Cumbria. The Eden is also of regional importance for wintering wildfowl and otters. Throughout the River Eden there are stands of riparian alder (*Alnus glutinosa*), or willow (*Salix*) sp. woodland associated with backwaters and seasonally flooded channels. The site interest includes the following habitat and species listed in the *EC Habitats and Species Directive (92/43/EEC)* (European Commission,	Roundabout – Adjacent Penrith to Temple Sowerby (Center Parcs) – Adjacent Temple Sowerby to Appleby – Within Appleby to Brough (Warcop) – 0.6 km south-west

Site	Reason for designation	Approximate location to schemes (within 2km)
	1992)[51] which continues to have effect post-Brexit as a result of the domestic Habitats Regulations: • Floating vegetation of plain and sub-mountainous rivers • White-clawed crayfish (*Austropotamobius pallipes*) • Atlantic salmon (*Salmo salar*) • Brook lamprey (*Lampetra planeri*) • River lamprey (*Lampetra fluviatilis*) • Sea lamprey (*Petromyzon marinus*) • Bullhead (*Cottus gobio*) • Otter (*Lutra lutra*) The SSSI also has geological interest: Geological Conservation Review Sites at Stenkrith Beck, Hilton Beck and River Belah are notified as part of this site.	
Udford Low Moss SSSI	The importance of Udford Low Moss for nature conservation lies in its interesting fen and 'carr-woodland' communities which together represent one of the very few, relatively intact valley fens in eastern Cumbria. The areas of willow and alder woodland and fen and fen grassland characterised by sedges and rushes are all of high value. Of subsidiary interest are smaller areas of rather drier grassland, scrub and different forms of woodland. Relatively little is known about the faunal interests of Udford Low Moss. The Winderwath area generally is valuable for birds with, for example, breeding records of redshank (*Tringa totanus*), water rail (*Rallus aquaticus*), snipe (*Gallinago gallinago*), reed bunting (*Emberiza schoeniclus*), sedge warbler (*Acrocephalus schoenobaenus*) and marsh tit (*Poecile palustris*). Red squirrel (*Sciurus vulgaris*), occurs and it is also likely that the long continuity of fen habitat at Udford will have maintained a rich diversity of insects.	Penrith to Temple Sowerby (Center Parcs) – 1.0 km north
Temple Sowerby Moss SSSI	Notable for its fen communities which over almost all of the site occur beneath a cover of alder/willow carr or in wet places under the birch (*Betula sp.*), dominated woodland that occupies the core of the site. Open fen communities are restricted in extent	Temple Sowerby to Appleby - 0.2 km north-west

[51] European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN

Site	Reason for designation	Approximate location to schemes (within 2km)
	and are largely confined to the periphery of the moss. A fringe carr, dominated by alder, grey willow (Salix cinerea), and bay willow (*Salix pentandra*), with a ground flora similar to that of the open fen, surrounds the woodland of the centre of the moss, into which it merges. Although the fauna of aquatic invertebrates lacks diversity, largely as a result of the dense woodland and carr cover, it is of interest in being of a type unusual in Cumbria. It includes the water beetle *Laccornis oblongus*, which is a distinctly rare and local species outside its centre of population in the central border counties of Scotland.	
Appleby Fells SSSI	The Appleby Fells form an extensive block of Pennine upland lying above the town of Appleby-in-Westmorland. The great importance of the area lies in its rich variety of habitats and associated plant and animal species. The most important vegetation communities are those of limestone grassland, limestone flush, blanket bog, heath and montane ledge, but other habitats of subsidiary interest are areas of acidic grassland, acidic flush, open water, limestone pavement and woodland. Blanket mire has developed over most of the ground and represents the most extensive habitat within the Appleby Fells. Much of it is typical hare's tail cotton grass (*Eriophorum vaginatum*), and heather mire are in relatively good condition and showing less of the peat erosion that is more in evidence further south in the Pennines. Around certain of the hill tops and on parts of the steep Pennine escarpment calcareous grasslands have developed around outcrops of Carboniferous limestone. Another form of Agrostis-Festuca grassland occurs along steep, partially screed slopes around the limestone scars. Blue moor-grass (*Sesleria caerulea*), predominates the area in association with spring and glaucous sedges (*Carex caryophyllea*), and (*C. Flacca*). Tall herb vegetation is a further important feature occurring on the ungrazed crags and ledges as well as on some of the steeper, inaccessible screes. The richest vegetation occurs on limestone rock, or	Appleby to Brough (Warcop) – 1.7km north

Site	Reason for designation	Approximate location to schemes (within 2km)
	ledges flushed by base-enriched water. On the more acidic sandstone, gritstone or whin sill ledges, an acid flora has developed. In some instances, this is over-topped by a dwarf canopy of rowan (*Sorbus aucuparia*), elm, hawthorn and, on the more basic crags, the uncommon rock whitebeam (*Sorbus rupicola*). In addition, there is an excellent range of upland crustose lichens especially on the acidic siliceous rocks. Throughout the altitudinal range of the Appleby Fells, particularly at the periphery of the peat bog, there are numerous base-rich flushes. On the steeper acidic slopes of the eastern escarpment and especially on gritstone boulder screes is a well-developed and extensive bilberry-crowberry (*Vaccinium-Empetrum*) dwarf shrub heath. Woodland is found as small fragments throughout the site, mostly on the lower fells and along some stream sections. Open water occurs in the Appleby Fells in the form of several upland streams (or becks) and as peat pools and some larger tarns on peat (e.g. *Little Rundale*) or gritstone (e.g. *Great Rundale*). The site supports an outstanding assemblage of breeding bird species. Upland waders are particularly important, with good populations of species such as golden plover, dunlin (*Calidris alpina*), snipe, oystercatcher (*Haematopus ostralegus*), common sandpiper (*Actitis hypoleucos*), and redshank. Other regularly seen species include merlin, peregrine, raven (*Corvus corax*) and barn owl (*Tyto alba*). Other faunal interest is provided by mine shafts which are now hibernation sites for Brandt's bat (*Myotis brandtii*), and whiskered bat (*Myotis mystacinus*).	
Helbeck Wood SSSI	Helbeck and nearby Swindale Woods are the northern-most examples of an internationally important series of Carboniferous limestone ash woods in the Pennines. Dominant ash (*Fraxinus excelsior*), with wych elm (*Ulmus glabra*), towards the margins. The major part of the wood has rich herb communities including dog's mercury (*Mercurialis perennis*), ramsons (*Allium ursinum*), and bluebell (*Hyacinthoides non-scripta*). The woodland floor communities are remarkable for the abundance of rare or uncommon species. The wood also contains interesting lichen species which are characteristic of	Appleby to Brough (Warcop) – 0.5 km north

Site	Reason for designation	Approximate location to schemes (within 2km)
	ancient woodland such as Lobaria laetevirens, Nephroma laevigatum and Thelotrema lepadinum. Two small artificial tarns are present within the woodland and a large number of breeding bird species have been recorded including buzzard (*Buteo buteo*), sparrowhawk (*Accipiter nisus*), ring ouzel (*Turdus torquatus*), redstart (*Phoenicurus phoenicurus*), wood warbler (*Phylloscopus sibilatrix*), spotted flycatcher (*Muscicapa striata*), pied flycatcher (*Ficedula hypoleuca*), and tree pipit (*Anthus trivialis*).	
Swindale Wood SSSI	Swindale and nearby Helbeck Woods are the northern-most examples of an internationally important series of Carboniferous limestone ash woods in the Pennines. This comprises predominantly ash woodland but includes rock outcrops and areas of more open grassland or flushes. This is particularly important for its rich flora and for being relatively little modified by forest management or sheep grazing. The woodland composition varies with position on the valley side. The woodland ground flora is rich with the most common species probably dog's mercury and bracken (Pteridium aquilinum). Mosses and liverworts are abundant in the wood with (*Ctenidium molluscum*) and (*Eurhynchium striatum*), two of the major species. There are not a great number of lichen species on the trees, perhaps because conditions are too shady and humid, however the species that do occur (e.g. *Catillaria sphaeroides; Thelotrema sp.*) are indicative of ancient woodland. Flushed ground occurs both within the woodland and out in the open. The flushes are characterised by rush species, quaking grass and sedges such as the glaucous, carnation and tawny sedges. A good range of breeding birds are recorded from the site. These include buzzard, sparrowhawk, woodcock (*Scolopax rusticola*), green woodpecker (*Picus viridis*), great-spotted woodpecker (*Dendrocopos major*), wood warbler, redstart, tree pipit, spotted and pied flycatchers and along the streams redshank, common sandpiper and dipper (*Cinclus cinclus*).	Appleby to Brough (Warcop) – 1.4 km north-east
Bowes Moor SSSI	Bowes Moor is an extensive tract of moorland in south-west Durham which comprises important areas of blanket bog with dry and wet heath, acid	Bowes Bypass (A66/A67) -

Site	Reason for designation	Approximate location to schemes (within 2km)
	grassland, flushes and small open water bodies and is particularly important because of its numerous and diverse moorland bird communities. Blanket bog covers most of Bowes Moor and this is dominated by heather (*Calluna vulgaris*), hare's tail cottongrass (*Eriophorum vaginatum*), common cottongrass (*E. angustifolium*) and deergrass (*Trichophorum cespitosum*), over a layer of bog mosses (*Sphagnum spp*.). Wet flushes occur throughout the moor and where grazing pressure is greater the blanket bog vegetation has been replaced by a wet heath/acid grassland. Shallower peats and drier mineral soils support heathland containing heather and bilberry and locally acid grassland. The breeding bird community of this moorland is of particular interest and includes substantial populations of golden plover, curlew (*Numenius arquata*), redshank, snipe and lapwing (*Vanellus vanellus*), together with smaller numbers of dunlin and birds of prey including merlin and short-eared owl, which are dependent on such large expanses of open moorland. The moor is managed for red grouse (*Lagopus lagopus scotica*), and also supports black grouse (*Tetrao tetrix*). Ring ouzel and wheatear (*Oenanthe oenanthe*), occur on the drier, rocky ground with dipper, common sandpiper and oystercatcher along the streams. Additional interest is provided by a number of small tarns which support colonies of black-headed gull (*Chroicocephalus ridibundus*), and waterfowl including teal (Anas crecca), mallard (*Anas platyrhynchos*), tufted duck (*Aythya fuligula*), and a significant proportion of the English breeding population of wigeon (*Anas penelope*).	0.35 km north-west
Kilmond Scar SSSI	Prominent south-facing scarp formed by rocks of the Upper Carboniferous Limestone formation, which although partially quarried in the past, support an interesting range of scree, rock-ledge and crevice, grassland, scrub and immature woodland vegetation On the shallow soils which are prone to drought, rock ledges, crevices and scree, open vegetation contains a well-developed moss layer, which contains an abundant number of drought tolerant annual and perennial species, including biting stonecrop Sedum acre and hairy rock-cress (*Arabis hirsutaa*).	Bowes Bypass (A66/A67) - 0.4 km south-east

Site	Reason for designation	Approximate location to schemes (within 2km)
	Deeper limestone soils support grasslands in which common bent (*Agrostis capillaris*) and red fescue (*Festuca rubra*) are prominent and a wide range of calcareous grassand species are also present. Blue moor-grass (*Sesleria albicans*), which has a northerly distribution in Britain, is a frequent component of such grasslands. In less heavily grazed situations, taller grassland occurs. Locally, on drift soils, neutral grassland occurs. Hawthorn (*Crataegus monogyna*), elder (*Sambucus nigra*), blackthorn (*Prunus spinosa*), and rose (*Rosa spp*.) are widely scattered through the grassland, in places forming closed scrub. Locally there is also immature ash woodland developed over an understorey of hazel (*Corylus avellana*), and a ground layer which contains woodland herbs such as cuckoo pint (*Arum maculatum*), sanicle (*Sanicula europaea*), and primrose (*Primula vulgaris*).	
Brignall Banks SSSI	The woodland clothes the steep slopes above the River Greta and its tributaries and forms one of the largest expanses of semi-natural woodland in north east England. Much of the woodland has received very little human interference in the past and is species rich containing a number of scarce species indicative of ancient woodland. On base-rich soils wych elm and ash mainly dominate over a well-developed shrub layer. The ground flora comprises a rich assemblage of species characteristic of such soils. On more acid soils and block scree, mature sessile oak (*Quercus petraea*), woodland occurs. In recent decades parts of the woodland have been felled resulting in the development of immature woodland while part of the site has been planted with ash, elm, oak, sycamore (*Acer pseudoplatanus*), and a small amount of conifer. The site supports a varied bryophyte and lichen flora, including several lichens which are sensitive to air pollution and rare in County Durham. These include the ancient woodland indicator species *Thelotrema lepadinum*, Graphis scripta, and various Pertusaria species. The woodland bird community includes great spotted woodpecker, pied flycatcher, redstart and woodcock,	Cross Lanes to Rokeby – 1.0 km south

Site	Reason for designation	Approximate location to schemes (within 2km)
	whilst along the River Greta, common sandpiper, dipper and goosander (*Mergus merganser*), occur.	
Crosby Ravensworth Fell SSSI	One of the few remaining areas of lowland heathland in Cumbria. Limestone pavements are an important feature of the site and form the western outliers of the Great Asby Complex of pavements. Other habitats which are of secondary interest but contribute to the overall value of the site include calcareous and acid grasslands and base-rich flushes. The heathland at Crosby Ravensworth is a dry acidic heath dominated by heather (*Calluna vulgaris*). The height, cover and structure of the heather varies quite markedly across the site depending on the incidence of burning, severity of grazing and degree of exposure. On the flatter, lower lying areas of the site, the dry heath grades into wet heath typified by cross-leaved heath (*Erica tetralix*), deer grass (*Scirpus cespitosus*), and the bog mosses (*Sphagnum spp.*). Dissecting the heathland is a complex system of shallow drainage channels which support plants normally associated with base-rich flushes. Limestone grassland exists where the soils over the limestone are very shallow, particularly around the small scars and pavements. The communities are not of outstanding interest but contribute to the overall value and diversity of the site. Where grazing levels have been high the heathland has given way to acid grassland. The limestone pavements on Crosby Ravensworth lie amidst the mosaic of heath, calcareous and acid grassland. The general exposure of the site, altitude and the effect of continued grazing has prevented the growth of many trees and shrubs on the pavements and there is little vegetation protruding above the grikes (the deep grooves between the blocks and clints). The grikes contain a range of herb and fern species. The site also supports an assemblage of typical moorland breeding birds such as golden plover, red grouse, redshank, oystercatcher, curlew and lapwing.	Adjacent to M6 (ARN)
Augill Valley Pasture SSSI	Important remaining example of an unimproved neutral northern grassland. Occupies ground which slopes steeply down to Augill Beck to the west.	Adjacent to A66 between Appleby to

Site	Reason for designation	Approximate location to schemes (within 2km)
	Unimproved grasslands are now a very rare habitat nationally. The grassland at Augill is particularly species-rich containing a number of rare and locally restricted plants and represents one of the most diverse of its kind within East Cumbria. The dominant grasses within the pasture are red fescue (*Festuca rubra*), and common bent (*Agrostis capillaris*), but a variety of other grasses are also present including sweet vernal-grass (*Anthoxanthum odoratum*), quaking grass (*Briza media*), Yorkshire fog (*Holcus lanatus*), downy oatgrass (*Avenula pubescens*), crested dog's-tail (*Cynosurus cristatus*), and heath grass (*Danthonia decumbens*). The herb component is very rich and forms a substantial proportion of the sward. Species of particular note include frog orchid (*Coeloglossum viride*), greater butterfly orchid (*Platanthera chlorantha*), fragrant orchid (*Gymnadenia conopsea*), adder's tongue-fern (*Ophioglossum vulgatum*), twayblade (*Listera ovata*), saw-wort (*Serratula tinctoria*), the nationally rare bird's-eye primrose (*Primula farinosa*) and in the damper areas of the field margins the increasingly scarce globeflower (*Trollius europaeus*). A number of sedges are also found including flea (*Carex pulicaris*), spring (*C. caryophyllea*), glaucous (*C. flacca*) and carnation sedge (*C. panicea*). Along the western edge of the pasture there is a gradual transition from grassland to woodland. Red squirrel and badger (*Meles meles*) are known to frequent the woodland.	Brough (Warcop) and Bowes Bypass (A66/A67) (ARN)
Argill Woods and Pastures SSSI	Argill Woods and Pastures straddle the slopes and occasional deep gorges of the Argill Beck and its tributaries for several kilometres. The woods and pasture comprise a mosaic of semi-natural woodland with unimproved grassland. The woodland is mostly ash dominated but the tree, shrub and ground flora vary with positions on the valley side and with soil type. Similarly, the unimproved grassland ranges from a dry, 'neutral' type, to more acidic or marshy types, to calcareous flushes. In addition, the waterfalls and wetter streamside habitats support a lush growth of mosses and liverworts. Birds recorded to have bred include teal, sparrowhawk, woodcock, common sandpiper, tawny owl (*Strix aluco*), dipper and pied flycatcher. Red	Adjacent to A66 between Appleby to Brough (Warcop) and Bowes Bypass (A66/A67) (ARN)

Site	Reason for designation	Approximate location to schemes (within 2km)
	squirrel, badger and roe deer also frequent the site and the mix of woodland, water and flower-rich clearings are important for butterflies and other insects.	
Cowraik Quarry Local Nature Reserve (LNR)	Since quarrying ceased natural colonisation has given rise to woodland with a shrub understorey and a species rich ground flora. Heathland occurs on the sandy areas. The woodland includes mature ash, birch, larch (*Larix sp*.), pine (*Pinus sp*.), sycamore and beech (*Fagus sp*.), with an understorey of birch, elder, hawthorn, rowan and ivy (Hedera helix). Heathland areas include heather and bilberry with bracken dominant on much of the site. Birds include greater spotted woodpecker, green woodpecker, tree creeper (*Certhia familiaris*), great tit (*Parus major*), and wren (*Troglodytes troglodytes*). Red squirrel and badger are found on site. The site is also designated as a SSSI for geological reasons	M6 Junction 40 to Kemplay Bank Roundabout – 1.8 km north east Penrith to Temple Sowerby (Center Parcs) - 1.8 km north

Non-statutory designated sites

7.5.7 There are 31 non-statutory designated sites within 2 km of the project (Figure 7.1 in Chapter 18: Figures) The sites located within 1 km are provided in Table 7-4.

Table 7-4: Non-statutory designated sites.

Site	Reason for designation	Approximate location to schemes (within 1 km)
Skirsgill Woods County Wildlife Site (CWS)	Broadleaved woodland (NGR: NY50752831).	M6 Junction 40 – potentially within or immediately adjacent M6 Junction 40 to Kemplay Bank Roundabout – 0.6km south-west
Yanwath Wood CWS	Broadleaved woodland (NGR: NY51332813).	M6 Junction 40 – 0.06km south M6 Junction 40 to Kemplay Bank Roundabout - 0.5km south
Myers Beck (Mardale Road) CWS	Myers Beck and associated riparian grassland (NGR: NY50942979).	M6 Junction 40 – 0.4km north M6 Junction 40 to Kemplay Bank Roundabout – 0.9km north-west
Whinfell Forest CWS	Mainly ancient replanted woodland with waterbodies and grassland mosaics (NGR: NY57762737).	Penrith to Temple Sowerby (Center Parcs) – Adjacent south

Site	Reason for designation	Approximate location to schemes (within 1 km)
Chapel Wood (Appleby in Westmorland) CWS	Broadleaved woodland (NGR: NY67072169).	Temple Sowerby to Appleby - Adjacent
Ross Wood CWS	Broadleaved woodland (NGR: NY67392121).	Temple Sowerby to Appleby - 0.25 km south
Sandford Mire CWS	Lowland Fens (NGR: NY72721705).	Appleby to Brough (Warcop) – 0.1 km south
Swindale Woodland CWS	Broadleaved woodland (NGR: NY78441393).	Appleby to Brough (Warcop) - 0.6 km south
Teesbank Woods, Rokeby Local Wildlife Site (LWS)	Mainly woodland, with river, bare rock and shingle banks (NGR: NZ075145).	Cross Lanes to Rokeby - 0.3 km north
Thorsgill Wood LWS	Ancient woodland (NGR: NZ05601514)	Cross Lanes to Rokeby - 0.6 km north
Rokeby Park and Mortham Wood LWS	Parkland, woodland and pasture (NGR: NZ0829013677).	Cross Lanes to Rokeby – Adjacent north
Aske Estate Woodlands Site of Importance for Nature Conservation (SINC)	Woodland – broadleaved, mixed and coniferous. Semi-natural and plantation. (NGR: NZ15910589)	Stephen Bank to Carkin Moor – 1 km south-east
Stephen Bank Road Verge SINC (Deleted)[52]	Road verge of relatively species-rich neutral grassland, mown at eastern end with areas of moderately dense cover of hawthorn and blackthorn. (NGR: NZ11931092)	Stephen Bank to Carkin Moor – Within

7.5.8 There are nine non-statutory designated sites situated within 200m of the ARN:

- Limekiln Wood LWS
- Ravensworth Park – Castle Fetch LWS
- Pallet Hill LWS
- Disused Railway Line Near Newbiggin LWS

[52] Surveyed and assessed against the SINC selection guidelines (by or on behalf of local authority) and found not to qualify as a SINC therefore is referred to as deleted. SINC that have been deleted should still be considered for any planning applications; these sites may not be of sufficient quality to qualify as a SINC but are still likely to be of higher ecological quality and wildlife value than other land in the area.

- Catterick Gravel Pits LWS
- Howe Hill Riverside LWS
- The Batts LWS
- Great Bottom Meadow CWS
- River Lyvennet Floodplain CWS

7.5.9 A search of the MAGIC website and Natural England Open Data at Option Selection stage highlighted the presence of several areas within the study area recognised as Section 41 (S41) habitats (i.e. they are registered on the Priority Habitat Inventory (PHI)). S41 habitats are considered to be of Principal Importance for conserving biodiversity in England.

7.5.10 The PHI on MAGIC does not include the S41 habitats 'ponds', 'rivers' or 'hedgerows'. Therefore, these habitats (identified from aerial photography and OS maps) were assumed to qualify as priority habitats at this stage until further field surveys are completed. In addition, the PHI on MAGIC is based on OS mapping, aerial photography, and information from sources such as Farm Environment Plan (FEP), Rural Land Registry (RLR) and Higher Level Stewardship (HLS). The accuracy of the PHI is therefore variable, there are gaps in coverage and it is often not supported by field survey data. In particular there may be areas of coastal floodplain grazing marsh associated with some of the rivers that are not included on the inventory. Field survey will be required to ensure that all S41 habitats are identified and assessed accordingly.

7.5.11 The S41 habitats identified are listed below with further information included in Table 7-5:

- Lowland mixed-deciduous woodland.
- Rivers.
- Ponds.
- Lowland fens.
- Coastal and floodplain grazing marsh.
- Purple-moor grass and rush pasture.
- Upland flushes, fens and swamps.
- Traditional orchard.
- Upland heathland.
- Wood-pasture and parkland.
- Hedgerows

7.5.12 In addition, ancient woodland and veteran trees have been recorded within the study area and are included in Table 7-5.

Table 7-5: Section 41 habitats, ancient woodland and veteran trees

Feature	Description/distribution	Approximate nearest location to Schemes (within 1km)
Lowland mixed-deciduous woodland	Recognised patches of deciduous woodland were occasional throughout the study area.	M6 Junction 40 - Adjacent M6 Junction 40 to Kemplay Bank Roundabout - Adjacent Penrith to Temple Sowerby (Center Parcs) - 0.07 km north Temple Sowerby to Appleby - Within Appleby to Brough (Warcop) – 0.03 km south

Feature	Description/distribution	Approximate nearest location to Schemes (within 1km)
		Bowes Bypass (A66/A67) - 0.28 km south Cross Lanes to Rokeby - Adjacent north Stephen Bank to Carkin Moor - Within A1(M) J53 Scotch Corner – 0.11 km west
Rivers and Streams	Present within all study areas. The study area includes (amongst other watercourses) River Eden, River Eamont, Trout Beck, Moor Beck, River Tees and River Greta. Several potential headwaters are also present. The rivers and streams (i.e. including unverified headwaters and unnamed watercourses) crossed by each scheme are listed below. Some watercourses are crossed multiple times: M6 Junction 40 and A1(M) J53 Scotch Corner do not cross any watercourses. M6 Junction 40 to Kemplay Bank Roundabout crosses one watercourse which has an existing culvert under the A66 (Thacka Beck). Penrith to Temple Sowerby (Center Parcs) crosses seven watercourses (unnamed tributary of Light Water, Light Water, three unnamed tributaries of River Eamont, Swine Gill and an unnamed tributary of Swine Gill). Temple Sowerby to Appleby crosses six watercourses (two unnamed tributaries of Birk Sike, Trout Beck, two unnamed tributaries of Trout Beck and an unnamed tributary of River Eden). Appleby to Brough (Warcop) crosses 13 watercourses (three unnamed tributaries of Mire Sike, two unnamed tributaries of Cringle Beck, Cringle Beck, Moor Beck, Eastfield Sike, Lowgill Beck, three unnamed tributaries of Lowgill Beck, Yosgill Sike).	M6 Junction 40 – 0.3 km south M6 Junction 40 to Kemplay Bank Roundabout - 0.2 km south-east Penrith to Temple Sowerby (Center Parcs) - Within Temple Sowerby to Appleby - Within Appleby to Brough (Warcop) - Within Bowes Bypass (A66/A67) - Within Cross Lanes to Rokeby – Within Stephen Bank to Carkin Moor – Within A1(M) J53 Scotch Corner – 0.7 km south-west

Feature	Description/distribution	Approximate nearest location to Schemes (within 1km)
	Bowes Bypass (A66/A67) crosses five watercourses (five unnamed tributaries of River Greta). Cross Lanes to Rokeby crosses 15 watercourses (unnamed tributary of Punder Gill, three unnamed tributaries of Manyfold Beck, Manyfold Beck, Punder Gill, Tutta Beck, three unnamed tributaries of Tutta Beck). Stephen Bank to Carkin Moor crosses two watercourses (two unnamed tributaries of Cottonmill Beck, Cottonmill Beck, Browson Beck, unnamed tributary of Browson Beck, five unnamed tributaries of Dalton Beck, two unnamed tributaries of Mains Gill, Mains Gill and two unnamed tributaries of Holme Beck).	
Ponds	Occurrence varied from absent to frequent throughout the study area. The number of waterbodies that are located within 250m of each scheme are: M6 Junction 40 – two waterbodies. M6 Junction 40 to Kemplay Bank Roundabout – three waterbodies. Penrith to Temple Sowerby (Center Parcs) – 13 waterbodies. Temple Sowerby to Appleby - 28 waterbodies. Appleby to Brough (Warcop) – 26 waterbodies. Bowes Bypass (A66/A67) – five waterbodies. Cross Lanes to Rokeby – eight waterbodies. Stephen Bank to Carkin Moor – ten waterbodies. A1(M) J53 Scotch Corner – seven waterbodies.	M6 Junction 40 – 0.1 km S M6 Junction 40 to Kemplay Bank Roundabout – Adjacent south Penrith to Temple Sowerby (Center Parcs) - 0.05 km south Temple Sowerby to Appleby – Adjacent south Appleby to Brough (Warcop) – Adjacent south Bowes Bypass (A66/A67) – 0.2 km south Cross Lanes to Rokeby - 0.1 km south-west Stephen Bank to Carkin Moor - Within A1(M) J53 Scotch Corner – 0.4 km east
Lowland Fens	Recognised areas were rare/infrequent within study area (two occurrences in total).	Appleby to Brough (Warcop) (western end) - 0.2 km south
Coastal and floodplain	Recognised areas were rare/infrequent within study area (two occurrences in total) and only within	Appleby to Brough (Warcop) (western end) - 0.2 km south

Feature	Description/distribution	Approximate nearest location to Schemes (within 1km)
grazing marsh	study area for Appleby to Brough (Warcop).	
Purple-moor grass and rush pastures	Recognised areas were rare/infrequent within study area (four occurrences in total) and only within study area for Appleby to Brough (Warcop).	Appleby to Brough (Warcop) (western end) - 0.25 km south
Upland flushes, fens and swamps	Recognised areas were rare/infrequent within study area (one occurrence in total) and only within study area for Appleby to Brough (Warcop).	Appleby to Brough (Warcop) - 0.85 km north
Traditional orchard	Recognised areas were rare/infrequent within the study area (two occurrences in total) and only within study area for Appleby to Brough (Warcop) and A1(M) J53 Scotch Corner.	Appleby to Brough (Warcop) - 0.05 km north A1(M) J53 Scotch Corner – 0.6 km south
Upland heathland	Recognised areas were rare/infrequent within study area (one occurrence in total) and only within study area for Bowes Bypass (A66/A67).	Bowes Bypass (A66/A67) - 0.13 km north-west
Wood-pasture and parkland	Recognised areas were rare/infrequent within study area (one occurrence in total) and only within study area for Cross Lanes to Rokeby.	Cross Lanes to Rokeby – Adjacent east
Hedgerow	Hedgerows are frequent within all schemes along the boundaries of agricultural fields.	Within all schemes
Ancient woodland and veteran trees	Ancient woodland was absent from M6 Junction 40, M6 Junction 40 to Kemplay Bank Roundabout, Bowes Bypass (A66/A67), Stephen Bank to Carkin Moor and A1(M) J53 Scotch Corner and infrequent within other section study areas. None of the projects were located adjacent to or crossed any recognised veteran tree records.	Penrith to Temple Sowerby (Center Parcs) – Adjacent S Temple Sowerby to Appleby - Adjacent south Appleby to Brough (Warcop) - 0.5 km north Cross Lanes to Rokeby – immediately adjacent

7.5.13 There are also 22 areas of ancient woodland within 200m of the ARN, the nearest of which is Bessygill Wood (NY54872170) which is adjacent to the M6 to the north of J55. The ARN is also located adjacent to the Morecambe Bay Limestones and Wetlands Nature Improvement Area (NIA) (adjacent to the M6, A6070 and B6384).

7.5.14 Ponds, watercourses and hedgerows have been identified from OS maps and aerial photography and their status as S41 habitat has been assumed. Furthermore, at this stage it is unknown whether any of the hedgerows also qualify as 'important' as per the *Hedgerows Regulations 1997 (as amended)* (Legislation, 1997)[53]

Protected and notable plants

7.5.15 The desk study at Option Selection stage identified the presence of several species of protected and notable plants within the study area of each option. Records include species listed on Schedule 8 of the *Wildlife and Countryside Act 1981 (as amended)* (Legislation, 1981)[54] such as bluebell (Hyacinthoides non-scripta), and species on national/county scarce/red lists. All schemes are predominantly located within common, widespread habitats that appear to be intensively managed for agriculture. However, habitats that may support protected/notable plant species include: areas recognised as priority habitat; ancient woodland and/or along wildlife corridors such as rivers, Roman roads and disused railway lines.

White-clawed Crayfish

7.5.16 White-clawed crayfish (Austropotamobius pallipes), have been recorded along watercourses within the study areas of schemes M6 Junction 40 to Kemplay Bank Roundabout, Penrith to Temple Sowerby (Center Parcs), Temple Sowerby to Appleby, Appleby to Brough (Warcop) and Cross Lanes to Rokeby. The River Eden SAC and River Eden and Tributaries SSSI support a large population of white-clawed crayfish (the species is included in the designation criteria for these designated sites).

7.5.17 Temple Sowerby to Appleby, Appleby to Brough (Warcop), and Cross Lanes to Rokeby cross sections of watercourse which may be suitable for white-clawed crayfish and M6 Junction 40 to Kemplay Bank Roundabout and Penrith to Temple Sowerby (Center Parcs) are located adjacent or in close proximity to such watercourses. Based on the presence of records, white-clawed crayfish are likely to be present in these areas.

Aquatic Invertebrates

7.5.18 No records of notable aquatic invertebrates were identified within the study area during the desk study undertaken at Option Selection stage. However, suitable habitat in the form of watercourses and waterbodies is /apresent in the study area and may support notable aquatic invertebrate species and assemblages.

Terrestrial Invertebrates

7.5.19 Records of approximately 50 species of notable terrestrial invertebrates were returned within the project study area. Species included Lepidoptera (butterflies and moths), with other species from the Diptera (flies), Hemiptera (true bugs) and Ephemeroptera (mayflies) orders. Terrestrial invertebrates have been recorded within the study areas for all project options, with the exception of Stephen Bank to Carkin Moor. The majority of records were associated with Temple Sowerby to Appleby.

7.5.20 All project options were found to be predominantly located within common and widespread habitats that appear to be intensively managed for agriculture and therefore unlikely to support significant assemblages of notable terrestrial invertebrates. Depending on condition and species diversity, areas recognised as

[53] Legislation (1997) The Hedgerows Regulations 1997 (as amended), available at: https://www.legislation.gov.uk/uksi/1997/1160/contents/made
[54] Legislation (1981) Wildlife and Countryside Act 1981 (as amended), available at: https://www.legislation.gov.uk/ukpga/1981/69

S41 Deciduous Woodland priority habitat, ancient woodland or wildlife corridors (such as rivers and streams, disused railways or old roman roads) may be important areas for notable invertebrates.

Fish

7.5.21 At Option Selection stage, records of protected fish species were identifed within the study areas of M6 Junction 40 to Kemplay Bank Roundabout, Penrith to Temple Sowerby (Center Parcs), Temple Sowerby to Appleby, Appleby to Brough (Warcop), Bowes Bypass (A66/A67) and Cross Lanes to Rokeby. Species included bullhead, brown trout Salmo trutta, Atlantic salmon, European eel Anguilla anguilla, and sea lamprey. Brook lamprey, river lamprey, sea lamprey, Atlantic salmon and bullhead are qualifying species of the River Eden SAC and River Eden and Tributaries SSSI.

Amphibians

7.5.22 Waterbodies were identified within 250m of each scheme using Option Selection stage data and review of OS and aerial mapping. The presence of records of amphibian species varied with some schemes having no records identified at Option Selection stage (Table 7-6). For schemes where there are no records, it should be noted that there may be suitable habitat present which has not previously been surveyed. The presence of barriers to amphibian movement has not been considered in the number of waterbodies included in Table 7-6 below.

Table 7-6: Waterbodies within 250m of each scheme and presence of amphibian records

Scheme	Number of waterbodies within 250m	Amphibian records within 2km
M6 Junction 40	2	Common frog *Rana temporaria,* common toad *Bufo bufo,* palmate newt *Lissotriton helveticus,* smooth newt *Lissotriton vulgaris,* great crested newt *Triturus cristatus,* and alpine newt *Ichthyosaura alpestris.*[55]
M6 Junction 40 to Kemplay Bank Roundabout	3	Common frog, common toad, palmate newt, smooth newt, great crested newt and alpine newt.
Penrith to Temple Sowerby (Center Parcs)	13	Palmate newt, smooth newt, great crested newt common frog and common toad.
Temple Sowerby to Appleby	28	Palmate newt, smooth newt, great crested newt common frog and common toad.
Appleby to Brough (Warcop)	26	Common frog and common toad.
Bowes Bypass (A66/A67)	5	Great crested newt.
Cross Lanes to Rokeby	8	No records identified.
Stephen Bank to Carkin Moor	10	Smooth newt and great crested newt.

[55] Alpine newt is an invasive non-native species listed on Schedule 9 of the *Wildlife and Countryside Act 1981 (as amended)*.

Scheme	Number of waterbodies within 250m	Amphibian records within 2km
A1(M) J53 Scotch Corner	7	Smooth newt.

Reptiles

7.5.23 There are records of slow worm (Anguis fragilis) and adder (Vipera berus) within 2 km of Cross Lanes to Rokeby. There are records of common lizard (Zootoca vivipara) within 2 km of M6 Junction 40, M6 Junction 40 to Kemplay Bank Roundabout, Penrith to Temple Sowerby (Center Parcs) and Bowes Bypass (A66/A67). The habitats within the study area are largely unsuitable for reptiles due to the prevalence of agricultural land (arable and pasture). Nevertheless, pockets of suitable habitat for reptiles may exist within the study area and will be identified following further detailed habitat assessment as part of the EIA.

Birds

7.5.24 There are a large number of bird records within the project study area. This includes species listed on Schedule 1 of the *Wildlife and Countryside Act 1981 (as amended)* and species included on the Red and Amber Lists of Birds of Conservation Concern. The majority of records relate to passerine birds typical of farmland and hedgerow habitats but also records of species associated with open habitats such as raptors and waders.

7.5.25 Records of several notable bird species which are likely to be found within the project's zone of influence include: lapwing, curlew, oystercatcher, snipe, redshank, pink-footed goose (Anser brachyrhynchus), whooper swan (Cygnus cygnus), woodcock, redwing (Turdus iliacus), fieldfare (Turdus pilaris), black redstart (Phoenicurus ochruros), kingfisher (Alcedo atthis), golden plover (qualifying species of North Pennine Moors SPA) and barn owl. Records of sand martin were also identified (included within the River Eden and Tributaries SSSI designation).

7.5.26 The majority of habitats within the study area provide a range of breeding and foraging opportunities for species typical of farmland, woodland and watercourse/wetland habitats such as those identified during the desk study.

Bats

7.5.27 Eight species of bat have been recorded within the study area: common pipistrelle (Pipistrellus pipistrellus), soprano pipistrelle (Pipistrellus pygmaeus), noctule (Nyctalus noctula), brown long-eared bat (Plecotus auritus), whiskered bat (Myotis mystacinus), Brandt's bat (Myotis brandtii), Daubenton's bat (Myotis daubentonii) and Natterer's bat (Myotis nattereri). Records of roosts including maternity roosts were identified along with records of commuting/foraging bats.

7.5.28 The study area of all schemes have potential bat roosting features providing a variety of conditions/variation for roosting bats within both built structures and trees.

7.5.29 Mature trees are located across the study area within woodland, copses and avenues. These are interlinked by a network of hedgerows and watercourses. Foraging bats have historically been confirmed within the study area. At Option Selection stage, the most important areas for foraging/commuting bats were considered to be sections bisecting or in close proximity to the River Eden SAC/River Eden and Tributaries SSSI (M6 Junction 40 to Kemplay Bank Roundabout, Penrith to Temple Sowerby (Center Parcs), Temple Sowerby to Appleby), along with potential wildlife corridors such as disused railway lines (Temple Sowerby to Appleby) and

disused Roman roads (Temple Sowerby to Appleby), or within or in close proximity to ancient woodland (Temple Sowerby to Appleby and Cross Lanes to Rokeby).

Badger

7.5.30 A large number of badger records were identified within the study areas associated with all schemes. Suitable habitat for badger is present within the study area for all schemes including woodland, hedgerows, scrub, and grassland habitats.

Hazel Dormouse

7.5.31 Analysis of biological record data has established that there are no historical records of hazel dormouse (Muscardinus avellanarius) within 2 km of any of the schemes. There are scattered populations of hazel dormouse in northern English counties due to a release programme, and small natural populations remain in Cumbria. However, these are restricted to south-west Cumbria, over 30 km to the south west of the project (People's Trust for Endangered Species, 2016)[56].

Otter

7.5.32 A large number of otter records were returned along watercourses within the study areas of all schemes except A1(M) J53 Scotch Corner. There are also a number of records along the A66, including within the indicative DCO boundary of Penrith to Temple Sowerby (Center Parcs), Temple Sowerby to Appleby and Bowes Bypass (A66/A67). Otter is one of the qualifying features of the River Eden SAC and is included within the citation of the River Eden and Tributaries SSSI.

7.5.33 With the exception of A1(M) J53 Scotch Corner, all schemes cross and/or are located adjacent or in close proximity to watercourses likely to support otter.

Water Vole

7.5.34 Records of water vole (*Arvicola amphibius*), have been identified within 2km of Appleby to Brough (Warcop).

7.5.35 A water vole reintroduction project in the Warcop area was carried out in 2007 with further releases in 2010. This project has been coordinated by the Cumbria Water Vole Project based at Cumbria Wildlife Trust in partnership with Eden River Trust (Cumbria Biodiversity Data Centre, 2010)[57]. Sites are appropriately managed by landowners in conjunction with the Environment Agency and the Cumbria Water Vole Project.

7.5.36 Trapping of American mink (Neovision vision), occurs widely throughout Cumbria for water vole, most intensively on the River Eden catchment where an organised control project is in place, managed by Cumbria Water Vole Project.

7.5.37 There are no records of water vole within 2km of any of the other schemes. There are records of American mink within the study areas of Temple Sowerby to Appleby, Bowes Bypass (A66/A67) and Cross Lanes to Rokeby which may limit the range of water vole within these areas.

7.5.38 Suitable habitat for water vole including watercourses, ditches and waterbodies, is present within the study area of all schemes.

[56] People's Trust for Endangered Species (2016) The State of Britain's Dormice, available at: https://ptes.org/wp-content/uploads/2016/09/State-of-Britains-Dormice-2016.pdf
[57]Cumbria Biodiversity Data Centre (2010) Water Vole Version 2.1 April 2010, available at: http://www.cbdc.org.uk/uploads/cbeb/statements/CBEB-WaterVole.pdf

Red Squirrel

7.5.39 Large numbers of red squirrel, records have been identified within the study areas of M6 Junction 40, M6 Junction 40 to Kemplay Bank Roundabout, Penrith to Temple Sowerby (Center Parcs), Temple Sowerby to Appleby and Appleby to Brough (Warcop). Two records were also identified at Cross Lanes to Rokeby.

7.5.40 The study areas of the schemes where red squirrel records have been identified also contain areas of woodland which have the potential to support red squirrel.

Other Terrestrial Mammals

7.5.41 European hedgehog (Erinaceus europaeus), European polecat (Mustela putorius) and brown hare (Lepus europaeus), and deer have been recorded within the study area relating to:

- European hedgehog – M6 Junction 40, M6 Junction 40 to Kemplay Bank Roundabout, Temple Sowerby to Appleby, Appleby to Brough (Warcop), Bowes Bypass (A66/A67) and Cross Lanes to Rokeby.
- European polecat – M6 Junction 40, M6 Junction 40 to Kemplay Bank Roundabout, Penrith to Temple Sowerby (Center Parcs), Temple Sowerby to Appleby, Appleby to Brough (Warcop) and A1(M) J53 Scotch Corner.
- Brown hare – M6 Junction 40, M6 Junction 40 to Kemplay Bank Roundabout, Penrith to Temple Sowerby (Center Parcs), Temple Sowerby to Appleby, Appleby to Brough (Warcop), Bowes Bypass (A66/A67) and Cross Lanes to Rokeby.
- Deer – deer have been included due to the potential impact of Road Traffic Accidents (RTAs) rather than for their conservation status. Records of roe deer (Capreolus capreolus), were identified within the study areas of M6 Junction 40, M6 Junction 40 to Kemplay Bank Roundabout, Penrith to Temple Sowerby (Center Parcs), Temple Sowerby to Appleby, Appleby to Brough (Warcop), Bowes Bypass (A66/A67) and Cross Lanes to Rokeby. A record of red deer (Cervus elaphus) was also identified within the study area of Appleby to Brough (Warcop).

7.5.42 Suitable habitat for European hedgehog, European polecat, brown hare and deer is present throughout the study area of all schemes. Consequently, these species are considered likely to be distributed throughout the project study area.

Field Survey

7.5.43 Field surveys undertaken at Option Selection stage included Phase 1 Habitat survey and HSI assessment at Temple Sowerby to Appleby, River Eden SAC survey (RHS, RCS and geomorphological assessment), and breeding bird surveys at Appleby to Brough (Warcop) and Bowes Bypass (A66/A67). The results of these surveys are described below.

Phase 1 Habitat Survey

7.5.44 The majority of the land within the study area at Temple Sowerby to Appleby was either intensively grazed improved grassland fields or arable land. The study area was rural with some built land, including the villages of Kirkby Thore, Crackenthorpe and Appleby-in-Westmorland. There were also several farms throughout the landscape. Broadleaved, mixed and coniferous plantation woodland was recorded in addition to broadleaved semi-natural woodland associated with Crackenthorpe Hall, Chapel Wood CWS, Ross Wood CWS and St Nicholas' Wood which is associated with the River Eden. Other habitats included dense scrub, semi-improved grassland, amenity grassland, tall ruderal herbs, watercourses and waterbodies. Himalyan

balsam (Impatiens glandulifera), was recorded within woodland and along the banks of Trout Beck and the River Eden. A large proportion of field boundaries within the study area were planted with hedgerows. The majority were species-poor (approximately 85% of the total) and intact (approximately 80% of the total). Approximately 15% had standard trees.

7.5.45 HSI assessments recorded that of three waterbodies located within 500m of Temple Sowerby to Appleby, P10 was assessed as 'Excellent' suitability for great crested newts and P11 and P12 were assessed as 'Good'. All other waterbodies within 500m of Temple Sowerby to Appleby were found to be defunct (no longer functional as waterbodies).

7.5.46 A summary of the potential presence of ecological receptors at Temple Sowerby to Appleby is provided in Table 7-7.

Table 7-7: Potential presence of ecological receptors at Temple Sowerby to Appleby as determined at previous Option Selection stage assessment

Ecological Receptor	Previous Option Selection Stage Assessment for Temple Sowerby to Appleby
Protected and notable plants	Confirmed Presence
Invasive flora	Confirmed Presence
White-clawed crayfish	Medium
Aquatic invertebrates	Medium
Terrestrial invertebrates	Low
Fish	Up to High
Amphibians	Up to Medium
Reptiles	Negligible
Birds	High
Bats	High
Badger	Confirmed Presence
Hazel dormouse	Negligible
Otter	Confirmed Presence
Water vole	High
Red squirrel	High
Other mammals	High

River Eden SAC survey

7.5.47 The River Eden SAC survey was undertaken at the River Eden, Trout Beck and Keld Sike at Option Selection stage. Throughout the river survey area, there were no instances of the habitats listed as conservation objectives for the River Eden SAC. Whilst there were bankside areas of woodland comprising alder and ash throughout the Trout Beck corridor, these were not considered sufficiently extensive to constitute alluvial forests. The understory occasionally featured common nettle (Urtica dioica), and butterbur (Petasites hybridus), but they did not occur on the characteristic shingle and gravels of actively moving channels to be considered good examples of the habitat.

7.5.48 The in-channel vegetation throughout the corridor was not extensive and reduced in complexity over the course of Trout Beck, comprising mainly filamentous algae with

some submerged, linear-leaved macrophytes. Water-crowfoot beds were present in both the upper and lower course of the river corridor, but few species were present and the vegetated areas were limited. Trout Beck has been modified in the past and hence has a poorer river habitat complexity however Eden Rivers Trust, Natural England and partners are working to restore this section of the SAC/SSSI.

7.5.49 There were no areas of shingle or sandbanks to indicate suitable habitat for terrestrial invertebrates at the crossing point of Temple Sowerby to Appleby at Trout Beck (Survey Area 9). Exposed gravel deposits were infrequent throughout the course of Trout Beck given the channel size. In comparison with the lower course of the River Eden, it is unlikely that the meanders and channel would accommodate high value habitat for invertebrates. An assessment of likely ecological receptors at the Temple Sowerby to Appleby crossing point of Trout Beck is provided in Table 7-8.

Table 7-8: Option Selection stage assessment of likelihood of ecological receptors at the Temple Sowerby to Appleby crossing of Trout Beck (forms part of River Eden SAC and River Eden and Tributaries SSSI)

Ecological Receptor	Option Selection Stage Assessment Status	Likelihood of Presence
Atlantic salmon	Likely to be present. Four desk study records within the corridor, two of which are along Trout Beck; located approximately 270m downstream. Records of salmon fry associated with site within Survey Area 9 in 2002 (Eden Rivers Trust). Gravel/pebble substrate provides suitable habitat for juvenile parr but lacks optimal spawning habitat.	Up to High
Sea, brook and river lamprey	Potentially present. Single desk study record within Trout Beck river corridor; approximately 270m downstream. Some suitable bed substrate habitat for ammocoetes where silt/sand is present – some deposits with dominant gravel/pebble substrate. No records from electrofishing surveys (Eden Rivers Trust) between 2002 and 2015.	Medium
Bullhead	Likely to be present. Records associated with site within river Survey Area 9 during 2002 electrofishing surveys (Eden Rivers Trust). Channel substrate and flow conditions suitable within river Survey Area 9, habitat is not extensive throughout the corridor.	Medium
White-clawed crayfish	Potentially present. No desk study records within river Survey Area 9, closest record associated with the River Eden approximately 3.5km south. Channel substrate suitable for provision of refugia within gravel/pebble bed.	Medium

Ecological Receptor	Option Selection Stage Assessment Status	Likelihood of Presence
Otter	Confirmed present. Desk study record located approximately 900m south of river Survey Area 9. An incidental sighting of a spraint was recorded during the River Eden SAC survey approximately 700m south-east of river Survey Area 9. Bank and channel characteristics provide suitable foraging habitat with opportunities for couches, holts and dens.	Confirmed Presence
Sand martin	Confirmed present. No desk study records within river Survey Area 9. Birds and burrows observed during River Eden SAC Survey. Bank features provide some suitable burrowing habitat within stable cliffs, and river corridor overall comprises foraging opportunities.	Confirmed Presence
Atlantic salmon	Likely to be present. Four desk study records within the corridor, two of which are along Trout Beck; located approximately 270m downstream. Records of salmon fry associated with site within Survey Area 9 in 2002 (Eden Rivers Trust). Gravel/pebble substrate provides suitable habitat for juvenile parr but lacks optimal spawning habitat.	Up to High

Breeding Bird survey – Appleby to Brough (Warcop) and Bowes Bypass (A66/A67)

7.5.50 Only one of the four bird species listed as qualifying features of the SPA were recorded within the survey undertaken at Appleby to Brough (Warcop) and Bowes Bypass (A66/A67) at Option Selection stage (Highways England, 2020c)[58]. Golden plover was observed twice at the transect undertaken at Bowes Bypass (A66/A67) on 16/04/2020:

- Single individual, seen only in flight
- Four count, seen only in flight

7.5.51 Peregrine, hen harrier and merlin were not recorded within the survey area. However, a single peregrine was observed flying north to south over the current A66 approximately 800m east at transect undertaken at Appleby to Brough (Warcop) on 11 May 2020.

7.5.52 The data collected suggested that the survey area is not important for European golden plover and does not support peregrine, hen harrier or merlin.

7.5.53 Barn owl were recorded along with a species composition considered typical of the surrounding upland habitats. Of the red and amber listed Birds of Conservation Concern (BoCC) recorded, songbirds and waders comprised the majority of the

[58] Highways England (2020c) Breeding Bird Survey Report. A66 Northern Trans-Pennine Project: Option 1 – Appleby to Brough and J – Bowes Bypass

species recorded. The most frequently recorded red or amber listed species were willow warbler (amber), oystercatcher (amber), lapwing (red) and curlew (red).

7.6 Potential impacts

Construction

7.6.1 The following impacts could occur during the construction phase:

- Temporary and permanent land take leading to fragmentation of the landscape in particular relation to schemes which are all or partially offline where habitats are intersected by the new road construction including Temple Sowerby to Appleby, Appleby to Brough (Warcop), Bowes Bypass (A66/A67), and Stephen Bank to Carkin Moor.
- Disturbance and compaction due to vehicle and plant movements causing damage to habitats.
- Potential Road Traffic Accidents (RTA) with fauna, for example badger, otter, deer, polecat and barn owl.
- Changes to drainage and the hydrological regime leading to loss, degradation and/or pollution of sensitive habitats. This is particularly relevant at the crossing at Trout Beck which forms part of the River Eden SAC and River Eden and Tributaries SSSI (Temple Sowerby to Appleby). There are also a further 22 watercourse crossings across the A66 NTP Project.
- New watercourse crossings and changes to existing road crossings may alter the natural functioning, hydrology and geomorphology of watercourses and their floodplains.
- Increased deposition of dust on sensitive habitats causing degradation, e.g. areas of ancient woodland adjacent to Temple Sowerby to Appleby, Chapel Wood CWS adjacent to Temple Sowerby to Appleby and Rokeby Park and Mortham Wood LWS adjacent to Cross Lanes to Rokeby.
- Increased deposition of nitrogen and other airborne pollutants due to diversions that cause increased traffic volumes in the wider road network (refer to the Chapter 6: Air Quality). Additional areas of ancient woodland, Crosby Ravensworth Fell SSSI, Augill Valley Pasture SSSI, Argill Woods and Pastures SSSI and Asby Compex SAC are within 200m of the ARN and therefore will require further assessment in relation to potential air quality impacts as part of the EIA.
- Increased mortality of some terrestrial faunal species due to entrapment in excavations, e.g. badger, otter, deer.
- Disturbance to sensitive species from noise and light pollution and vibration arising from construction activity, e.g. bats, ornithology, invertebrates.
- Accidental spills of chemicals and other potentially toxic substances from machinery into sensitive habitats. This is of particular relevance at the crossing of the River Eden SAC/River Eden and Tributaries SSSI, in addition to other watercourse crossings and sensitive habitats such as ancient woodland located in proximity to the project.

Operation

7.6.2 The following impacts could occur during the operation phase:

- Increased deposition of nitrogen and other airborne pollutants due to increased traffic volumes.

- Increased mortality of some species due to increased traffic volumes and changes in road layout.
- Increase in noise levels in adjacent habitats due to proximity to fast moving traffic.
- Increased lighting disturbance due to additional road lighting and signage.
- Increased human disturbance associated with emergency refuge areas.
- Ongoing pollution of sensitive habitats due to road run-off.

7.7 Design, mitigation and enhancement measures

Design

7.7.1 The project is still at the early stages of design. However, the following design recommendations should be considered:

- To avoid impacts at new and amended watercourse crossings across the project, it is recommended that new bridges are designed as clear spanning structures with abutments set well back from the river's edge. The biodiversity and geomorphological interest of watercourses extend beyond the river bed, river bank and immediate riparian habitat. It should be noted that the designated river habitat feature (of an SSSI or SAC) is taken to comprise all components of river habitat, including in-channel, marginal and riparian habitats and any adjacent floodplain habitats that are hydrologically dependent on the river. The hydrological, chemical, physical and biological elements of the river are all considered to be integral components of the notified river habitat feature, which provides the basis for direct protection of natural habitat function. Assessment of the potential impacts on the whole floodplain of watercourses will therefore be required as part of the design of new crossings. This has particular relevance for the crossing of Trout Beck within the Temple Sowerby to Appleby scheme where the length and design of the bridge will need to be established to avoid adverse impacts on the River Eden SAC, to still allow the river to function naturally within the whole floodplain, and to accommodate potential river restoration.
- Post-construction planting will aim to enhance the biodiversity value of the Highways England soft estate in the vicinity of the project. This will be measured by applying the Defra *Biodiversity Metric 2.0* (Natural England, 2019)[59]. Where reasonably practicable, this will include reinstating and re-linking severed linear wildlife corridors with new planting. Consideration will be given to the inclusion of locally sourced native plant species within planting proposals and the application of sensitive management and monitoring regimes.

Mitigation

7.7.2 The following embedded mitigation measures are considered integral to the project design and have been considered in determining the magnitude of impact:

- Construction impacts will be designed out/minimised as far as possible through, for example, minimising land-take/habitat loss and locating access tracks/haul roads and site compound/material storage areas outside of ecologically sensitive sites/habitats (such as statutory and non-statutory designated sites, ancient woodland and habitats registered on the Section 41 priority habitat inventory).
- Compensatory habitat will be provided to replace that which is lost through the project. Provision of replacement habitats will be designed to provide links

[59] Natural England (2019) The Biodiversity metric 2.0, available at: http://publications.naturalengland.org.uk/publication/5850908674228224

between existing areas of habitats to maximise benefits for biodiversity in so far as it is appropriate. Replacement habitats to be provided will be like for like or of a higher quality or biodiversity value than that lost whilst still supporting the same species affected (i.e. in terms of distinctiveness or condition, as measured using the Defra *Biodiversity Metric 2.0*).

- Replacement on-line habitats (within highways verge) will follow the Highways England objectives for low nutrient soils and biodiverse verges and will seek to enhance connectivity to existing habitats where appropriate. Highways England have already been working with Cumbria Wildlife Trust along other sections of the A66 to boost pollinator habitat.
- Any areas required for temporary works will be reinstated on completion of the works (where possible). Clearly demarcated dedicated access routes will be provided during construction.
- The project, and specific construction tasks, will aim to retain as many trees as possible.

7.7.3 The following essential mitigation measures are also integral to the project and have been considered in determining the magnitude of impact:

- In accordance with good practice, an Environmental Management Plan (EMP) will be produced in advance of construction works commencing. Impacts during construction will be controlled through strict adherence to the EMP that will be developed using good practice techniques, but also a suite of bespoke control measures to demonstrate compliance with relevant environmental legislation. In addition, with respect to the European Site designations, it will outline environmentally sensitive areas and detail how such areas will be protected during the construction works and subsequent maintenance.
- All site works would be carried out in accordance with good environmental working practices to ensure adequate pollution control measures are implemented during construction and operation with monitoring to ensure their effectiveness.
- Any works that disturb drainage features would include mitigation or reinstatement so that the features retain their correct working function.
- All trenches and work excavations would either be backfilled or covered overnight, or fenced off, to prevent animals falling in, or earth ramp(s) would be included to allow animals a means of escape.
- Short term airborne pollution resulting from site vehicle emissions and dust would be controlled through good practice measures such as wetting, if dictated by very dry weather conditions.
- Appropriate measures would be taken to avoid the spread of Invasive Non-Native Species (INNS) and diseases such as crayfish plague.
- Where tree surgery to the crown or roots of trees is necessary, this will be undertaken in accordance with *British Standard (BS) 3998:2010 Tree Work Recommendations* (British Standard, 2010)[60] and appropriate Arboricultural Association advice notes.
- The presence of important ecological features may have implications for the timing of construction activities. The avoidance of periods of particular sensitivity is considered good practice for protected species such as nesting birds, reptiles and amphibians.
- In the event that there is a likelihood of adverse effects on protected species (such as great crested newts, bats, otter, water vole or badger for example), the

[60] British Standard (2010) BS 3998:2010 Tree Work Recommendations

project will only proceed under a licence granted by Natural England if that body is satisfied that the relevant requirements are met.. Where appropriate, specific mitigation and compensation measures will be carried out in such circumstances.

- Where certain important ecological features have been identified or where there is potential for them, and impacts cannot be avoided during construction, Reasonable Avoidance Measures and/or Precautionary Working Methods (PWM) will be developed and implemented under supervision by an Ecological Clerk of Works (ECoW). If any protected species are found during unsupervised construction activities, then works will be put on hold until the ECoW has been contacted to advise on how to proceed.
- Pre-construction checks/surveys will be carried out where required.

Enhancement considerations

7.7.4 In line with national and local policy, consideration will be given to ensuring the soft estate is landscaped in such a way as to provide habitats of greater ecological value than those that are lost and to enhance connectivity, e.g. by altered management of retained habitat and/or planting treelines/hedgerows to provide safe commuting routes for wildlife. This may also include enhancement of areas required for temporary land-take during construction, e.g. compound areas and access tracks and retro-fitting of culverts. Improved environmental outcomes are also a target of Highways England's *Road Improvement Strategy 2 (RIS2)* (Department for Transport, 2020)[61] and Highways England's Biodiversity Plan (Highways England, 2015)[62], which aims to halt the decline in the vitality of habitats and plant and animal populations on and around their network. Highways England's biodiversity commitments for all *RIS2* projects are to maximise biodiversity delivery in all activities commenced within the *RIS*. Highways England's commitment is to achieve no net loss at an organisational level and all projects are required to maximise biodiversity delivery to contribute to this outcome.

7.7.5 Detailed and species-specific enhancement measures will be considered as part of the EIA once ecological surveys have been undertaken.

Monitoring requirements

7.7.6 No specific monitoring requirements have been identified at this stage; however, it is recognised that ecological conditions may change before the start of construction works, and up-to-date information may be required to facilitate the implementation of mitigation works and ensure required mitigation is effective. Potential monitoring requirements will be outlined in the Environmental Statement (ES) as appropriate. This may include monitoring of road run-off/discharges from SuDS to ensure there is no pollution of watercourses.

7.8 Description of the likely significant effects

7.8.1 Impacts relating to dust deposition, air/noise/light pollution, vibration, accidental spills and entrapment of animals during construction activities, can be controlled through the implementation of good practice techniques. The effects on ecological receptors

[61] Department for Transport (2020) Road Investment Strategy 2: 2020-2025, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872252/road-investment-strategy-2-2020-2025.pdf

[62] Highways England (2015) Biodiversity Action Plan, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/441300/N150146_-_Highways_England_Biodiversity_Plan3lo.pdf

as a result of these impacts are unlikely to be significant however will be reconsidered as part of the EIA.

7.8.2 Statutory designated sites which have been scoped out at this stage include Moor House-Upper Teesdale SAC, Udford Low Moss SSSI, Swindale Wood SSSI, Brignall Banks SSSI and Cowraik Quarry LNR. This is due to the distance between the designated sites and the project (> 1 km) and absence of potential impact pathways (e.g. absence of hydrological or other connectivity). In relation to the Appleby to Brough (Warcop) scheme, Helbeck and Swindale Woods SAC and Helbeck Wood SSSI have also been scoped out at this stage due to the distance (>0.5 km), topography and absence of potential impact pathways and in accordance with *LA 105* (see Chapter 6: Air Quality).

7.8.3 A summary of the statutory designated sites and other ecological receptors that have been scoped out at this stage is provided in Table 7-9.

Table 7-9: Ecological receptors scoped out at this stage.

Ecological Receptor	Stages Scoped Out	Justification
Moor House-Upper Teesdale SAC	Construction and Operation	Site is designated for botanical interest and the round-mouthed whorl snail (*Vertigo genesii*). No adverse impacts anticipated due to distance (1.1 km from Appleby to Brough (Warcop)), relative topography, absence of potential impact pathways (e.g. hydrology, air quality) and lack of habitat connectivity to the project for round-mouthed whorl snail (tiny boreal and alpine species - in the UK, it is found in calcareous flushes including rich assemblages of local plants, often with an arctic-alpine element). In the Moor House-Upper Teesdale SAC, the round-mouthed whorl snail lives amongst moss, low-growing sedges and a rich assemblage of rare and local arctic-alpine plants such as bird's-eye primrose (*Primula farinosa*) and Scottish asphodel (*Tofieldia pusilla*). The round-mouthed whorl snail is found at a number of base-rich flushes around the slopes of Widdybank Fell and at isolated flushes further east on Cronkley Fell and Holwick Fell, at altitudes between 400 m and 525 m (Joint Nature Conservation Committee, 2021)[63]. Habitats within the scheme are at lower altitude and remote from the known populations with little suitable habitat within the scheme or connecting it to the SAC, therefore the likely presence of round mouth whorl snail within the scheme is considered negligible.
Udford Low Moss SSSI	Construction and Operation	No adverse impacts anticipated on key interests of SSSI (wet woodland communities) due to distance and absence of potential impact pathways (i.e. no hydrological or other links). At its nearest point to the project, the SSSI is located approximately 1km away from Penrith to Temple Sowerby (Center Parcs).

[63] Joint Nature Conservation Committee (2021) 1015 Round-mouthed whorl snail *Vertigo genesii,* available at: https://sac.jncc.gov.uk/species/S1015/

Ecological Receptor	Stages Scoped Out	Justification
Swindale Wood SSSI	Construction and Operation	Designated for botanical interest (woodland) therefore no adverse impacts anticipated due to distance (1.4 km from Appleby to Brough (Warcop)), relative topography and absence of potential impact pathways (e.g. hydrology, air quality).
Brignall Banks SSSI	Construction and Operation	Designated for botanical interest (woodland) therefore no adverse impacts anticipated due to distance across an agricultural landscape (1.0 km south of Cross Lanes to Rokeby) and absence of potential impact pathways (e.g. hydrology, air quality).
Cowraik Quarry LNR	Construction and Operation	No adverse impacts anticipated due to distance across an urban/agricultural landscape (1.8km from M6 Junction 40 to Kemplay Bank Roundabout and 1.8 km from Penrith to Temple Sowerby (Center Parcs)) and absence of potential impact pathways.
Helbeck & Swindale Woods SAC	Construction and Operation	Site is designated for botanical interest (mixed woodland on base-rich soils associated with rocky slopes) and therefore no adverse impacts anticipated due to distance (0.5 km from Appleby to Brough (Warcop)), relative topography and absence of potential impact pathways (e.g. hydrology, air quality).
Helbeck Wood SSSI	Construction and Operation	Site is designated for botanical interest (woodland) therefore no adverse impacts anticipated due to distance (0.5 km from Appleby to Brough (Warcop)), relative topography and absence of potential impact pathways (e.g. hydrology, air quality).
Myers Beck (Mardale Road) CWS	Construction and Operation	No adverse impacts anticipated due to the distance from the project (0.8 km from M6 Junction 40 and 0.9 km from M6 Junction 40 to Kemplay Bank Roundabout) and absence of potential impact pathways (urban/industrial land including Penrith Industrial Estate is located between the A66 project and this CWS).
Swindale Woodland CWS	Construction and Operation	Designated for botanical interest (woodland) therefore no adverse impacts anticipated due to distance (0.6 km from Appleby to Brough (Warcop)) and absence of potential impact pathways (e.g. hydrology, air quality).
Aske Estate Woodlands SINC	Construction and Operation	Designated for botanical interest (woodland). No adverse impacts due to distance (1 km from Stephen Bank to Carkin Moor) and absence of potential impact pathways (e.g. hydrology, air quality).
Yanwath Wood CWS	Operation only	Scoped out at the operational stage due to the distance of this site from the project (located 0.6 km from M6 Junction 40 (closer distance in Table 7-4 relates to potential mitigation planting areas) and 0.5km south of M6 Junction 40). There is therefore an absence of

Ecological Receptor	Stages Scoped Out	Justification
		operational impact pathways in relation to light, noise and pollution.
Thorsgill Wood LWS	Construction and Operation	Designated for botanical interest (woodland). No adverse impacts due to distance (0.6 km from Cross Lanes to Rokeby) and absence of potential impact pathways (e.g. hydrology, air quality).
Teesbank Woods, Rokeby LWS	Operation only	Scoped out at the operational stage due to the distance of this site from the project (0.3 km north of Cross Lanes to Rokeby) and therefore the absence of operational impact pathways in relation to light, noise and pollution.
Upland Flushes, Fens and Swamps Priority Habitat	Construction and Operation	There is one area of this habitat within 1km of the project located 0.85 km to the north of Appleby to Brough (Warcop). This has been scoped out due to the distance, topography and absence of potential impact pathways (e.g. hydrology, air quality).
Traditional Orchard Priority Habitat	Construction and Operation	Located approximately 50 m to the north of Appleby to Brough (Warcop) and is situated across the existing A66. No potential indirect impact pathways have been identified – not identified as a sensitive receptor in relation to potential air quality impacts and not featured on the APIS website (Air Pollution Information System, 2021)[64] In relation to A1(M) J53 Scotch Corner, the traditional orchard habitat is located 600m from the scheme.
Hazel dormouse *Muscardinus avellanarius*	Construction and Operation	There are no historical records of hazel dormouse *Muscardinus avellanarius* within 2 km of the project and no optimal suitable habitat has been identified within 250 m of the indicative DCO boundary. Therefore, no further surveys are necessary and hazel dormouse can be scoped out due to no significant impacts being anticipated.

7.8.4 The significance of effects as a result of the remaining construction and operational impacts described in Section 7.4 is dependent on the presence of sensitive habitats and species, which requires further survey and/or assessment as part of the EIA. This will also inform mitigation requirements to reduce the impact and subsequently determine residual effects. As such, it is uncertain at this stage whether effects will be significant. This certainty will increase as the project proceeds through the EIA and ecological surveys and/or assessments are undertaken (as part of the EIA). Assumed presence and a precautionary approach to the impact assessment (assuming worst-case) may be required to inform design development and mitigation design in the event that surveys cannot be fully completed in all areas prior to completion of the EIA. Examples of where this may be required include where sites suitable for bat or reptile hibernation are identified which may require survey in

[64] Air Pollution Information System (2021) Guide to habitats used in APIS, available at http://www.apis.ac.uk/habitat_table.html

autumn/winter 2021/22. All assumptions will be verified through surveys and the implementation of appropriate mitigation, where required, during the detailed design and construction stages. The following presents an assessment of the likely significant effects, based on the Option Selection stage *EAR* (Highways England, 2018)[65] for Schemes 2 to 9. Residual significance level is only reported in this ESR and the detail of receptor value and magnitude of effect is contained within the Option Selection stage *EAR*. None of the receptors described have been scoped out at this stage and the assessment will be refined through the EIA to report significance of effects.

M6 Junction 40

7.8.5 Neutral or slight adverse – Deciduous Woodland Priority Habitat, birds, bats, badger, red squirrel, amphibians (including great crested newt), protected/notable plants, terrestrial invertebrates, other mammals.

M6 Junction 40 to Kemplay Bank Roundabout

7.8.6 Moderate adverse – River Eden SAC, River Eden and Tributaries SSSI, Rivers and Streams Priority Habitat, birds.

7.8.7 Neutral or slight adverse – Deciduous Woodland Priority Habitat, Hedgerows, other habitats (non-S41), protected/notable plants, fish, terrestrial invertebrates, reptiles, bats, badger, otter, red squirrel, other mammals, amphibians (including great crested newt).

Penrith to Temple Sowerby (Center Parcs)

7.8.8 Moderate adverse – River Eden SAC, River Eden and Tributaries SSSI, Rivers and Streams Priority Habitat, white-clawed crayfish, birds.

7.8.9 Neutral or slight adverse – Hedgerows, other habitats (non-S41), protected/notable plants. Aquatic invertebrates, terrestial invertebrates, amphibians (including great crested newt), reptiles, bats, badger, otter, water vole, red squirrel, other mammals.

Temple Sowerby to Appleby

7.8.10 It should be noted that this scheme is currently subject to further alternative aligment routes assessment, in part due to the potential impacts associated with the crossing of Trout Beck. Alternative route alignments under consideration include crossing Trout Beck further to the east, further to the west (closer to Kirby Thore) or a largely online route to the south of Kirby Thore. The process and outcome of this assessment will be set out in the ES, along with detailed impact assessment for the selected route. Further information on the potential significant effects of this scheme will be presented in the Preliminary Environmental Information (PEI) Report in due course.

7.8.11 Large adverse – River Eden SAC, River Eden and Tributaries SSSI, Rivers and Streams Priority Habitat, white-clawed crayfish, aquatic invertebrates.

7.8.12 Moderate adverse – Hedgerows, fish, birds.

7.8.13 Neutral or slight adverse - Deciduous Woodland Priority Habitat, other habitats (non-S41), protected/notable plants, terrestrial invertebrates, amphibians (including great crested newt), bats, badger, otter, water vole, red squirrel, other mammals (hedgehog, polecat, brown hare).

[65] Highways England (2018) A66 PCF Stage 1 Environmental Assessment Report

Appleby to Brough (Warcop)

7.8.14 As with the Temple Sowerby to Appleby section, this scheme is also subject to further alternative alignment routes assessment due to its close interaction with the North Pennines Area of Outstanding Natural Beauty (AONB). Alternative alignments immediately north of Warcop and an alternative tie-in further east along the existing A66 are under consideration. The process and outcome of this assessment will be set out in the ES, along with detailed impact assessment for the selected route. Further information on the potential significant effects of this scheme will be presented in the PEI Report in due course.

7.8.15 Large adverse – Rivers and Streams Priority Habitat, white-clawed crayfish.

7.8.16 Moderate adverse – North Pennine Moors SPA, hedgerows, birds, aquatic invertebrates, fish.

7.8.17 Neutral or slight adverse – Sandford Mire CWS, other habitats (non-S41), protected/notable plants, terrestrial invertebrates, amphibians, reptiles, bats, badger, otter, water vole, red squirrel, other mammals (hedgehog, polecat, brown hare).

Bowes Bypass (A66/A67)

7.8.18 Moderate adverse – North Pennine Moors SPA, birds.

7.8.19 Neutral or slight - Rivers and Streams Priority Habitat, hedgerows, other habitats (non-S41), protected/notable plants, aquatic invertebrates, terrestrial invertebrates, fish, amphibians (including great crested newt), reptiles, bats, badger, otter, water vole, other mammals (hedgehog, polecat, brown hare).

Cross Lanes to Rokeby

7.8.20 It should be noted that this scheme is currently subject to further alternative aligmment routes assessment. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected alignment route. Further information on the potential significant effects of this scheme will be presented in the Preliminary Environmental Information (PEI) Report in due course.

7.8.21 Moderate adverse – Rivers and Streams Priority Habitat, birds.

7.8.22 Neutral or slight - Hedgerows, other habitats (non-S41), protected/notable plants, white-clawed crayfish, aquatic invertebrates, terrestrial invertebrates, fish, amphibians (including great crested newt), reptiles, bats, badger, otter, water vole, red squirrel, other mammals (hedgehog, polecat, brown hare).

Stephen Bank to Carkin Moor

7.8.23 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected alignment route. Further information on the potential significant effects of this scheme will be presented in the Preliminary Environmental Information (PEI) Report in due course.

7.8.24 Moderate adverse – Rivers and Streams Priority Habitat, hedgerows.

7.8.25 Neutral or slight – Deciduous Woodland Priority Habitat, other habitats (non-S41), protected/notable plants, aquatic invertebrates, terrestrial invertebrates, fish, amphibians (including great crested newt), birds, reptiles, bats, badger, otter, water vole, other mammals (hedgehog, polecat, brown hare).

A1(M) Junction 53 Scotch Corner

7.8.26 Neutral or slight – Deciduous Woodland Priority Habitat, breeding birds, bats, badger, amphibians.

7.9 Assessment Methodology

Identifying design, mitigation and enhancement measures (and monitoring)

7.9.1 The following principles underpin the approach which will be taken during the assessment for design, mitigation and enhancement (adapted from CIEEM, 2018):

- Avoidance - Seek to avoid harm to ecological features.
- Mitigation - Adverse effects should be avoided or minimised through mitigation measures, either through the design of the project or subsequent measures that can be guaranteed - for example, through a condition or planning obligation.
- Compensation - Where there are significant residual adverse ecological effects despite the mitigation proposed, these should be offset by appropriate compensatory measures.
- Enhancements - Seek to provide net benefits for biodiversity over and above requirements for avoidance, mitigation or compensation.

7.9.2 The design and mitigation hierarchy outlined in *DMRB LA 104 Environmental assessment and monitoring* (Highways England, 2020c)[66] will be applied to avoid, reduce and remediate adverse effects on biodiversity resources. Where a residual effect continues to be significant, the hierarchy will be reapplied to reduce effects further. The development and implementation of biodiversity design and mitigation measures will follow the principles outlined in *DMRB LD 118*.

7.9.3 At this stage, the baseline conditions and thus the requirement for mitigation and enhancement are not fully understood. The EIA will include specific design and management measures incorporated into the project.

Assessment methodology

7.9.4 The assessment will be prepared in accordance with *DMRB LA 104 Environmental assessment and monitoring*, *LA 108 Biodiversity* and *LD 118 Biodiversity design*. In addition the assessment will be undertaken in accordance with the CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland.

7.9.5 The assessment will consider both construction and operation and will also be informed by the nitrogen deposition calculations undertaken as part of the air quality assessment (refer to Chapter 6: Air Quality) and acoustic modelling undertaken as part of the noise assessment refer to: Chapter 13: Noise and Vibration). Sensitive locations where information relating to air quality and noise will be required for the biodiversity assessment will be determined with the respective teams to ensure they are included within their data collection and modelling. The biodiversity assessment will then include comparison of the baseline scenario to construction and operational scenarios to determine whether the project is likely to impact on the biodiversity resource.

[66] Highways England (2020c) Environmental Assessment and Monitoring *LA 104*, available at: https://www.standardsforhighways.co.uk/dmrb/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a

7.9.6 The assessment will be informed by and integrated with various aspects of the Chapter 15: Road Drainage and the Water Environment including, the Water Framework Directive Compliance Assessment, Hydromorphological Assessment, Water Quality (HEWRAT) Assessment, Flood Risk Assessment, Hydrogeological Impact Assessment and Groundwater Dependant Terrestrial Ecosystems Assessment. In addition the assessment will be informed by and integrated with various aspects of Chapter 10: Geology and Soils in relation to potential for contamination and other impacts on soils and the associated impacts on biodiversity receptors. For example Chapter 10: Geology and Soils will present the baseline ground conditions in relation to the presence of peat which may inform the assessment of potential impacts on statutory designated sites and S41 habitats including lowland fens, upland flushes, fens and swamps and upland heathland.

Importance of biodiversity resource

7.9.7 The assessment will first focus on determining the importance of the biodiversity resources identified within the study area using the guidance in Table 3.9 of *DMRB LA 108*. Baseline studies (desk study and field survey) will establish the relative importance of the biodiversity resource as International or European importance, UK or national importance, Regional importance, County or equivalent authority importance or Local importance.

Level of impact

7.9.8 Following identification of the importance of biodiversity resources, the level of potential impacts will be identified. In *DMRB LA 108*, 'level of impact' is used in place of 'magnitude' in *DMRB LA 104*. Determination of the level of impact is assessed using the following characteristics:

- positive or negative (e.g. adverse/beneficial)
- duration (e.g. permanent/temporary)
- reversibility (e.g. irreversible/reversible)
- extent/magnitude
- frequency and timing.

7.9.9 Where possible, impacts will be quantified and expressed in absolute or relative terms (e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population) and the assessment will also identify where information on the scale or magnitude of potential impacts is not available. The level of impacts will be reported in accordance with the criteria provided in Table 3.11 of *DMRB LA 108* as Major, Moderate, Minor, Negligible or No Change. The level of impact will be informed by the outcomes of modelling and assessment of other environmental factors (where relevant) including air quality and noise and vibration.

Assessing significance

7.9.10 The ES will describe any likely signifcant effects of the project on biodiversity resources. The importance of the resource and level of impact will be used to determine the signficance of effect based on Table 3.13 of *DMRB LA 108* and the principles of *DMRB LA 104*. The significance of effects will be determined as adverse, beneficial or neutral (no change) ranging between Neutral, Slight, Moderate, Large and Very Large. Reporting of significant effects will include those assessed as Moderate, Large and Very Large. To retain consistency with other EIA topic chapters, whilst also ensuring compliance with *DMRB LA 108*, an agreed approach and matrix for evaluation of relative significance of effects will be used. However it should be

noted that this is not included within the CIEEM guidelines for EcIA and does not replace the CIEEM EcIA guidelines.

Proposed survey methodology

7.9.11 As part of the EIA, a full suite of surveys will be completed, where access is available. Preliminary Ecological Appraisal (PEA) within 250m of the construction boundary of each Scheme will be completed initially. The PEA will be undertaken in accordance with CIEEM *Guidelines for Preliminary Ecological Appraisal* (Chartered Institute of Ecology and Environmental Management, 2017)[67] and will be utilised to:

- identify the likely ecological constraints associated with the project
- identify any mitigation measures likely to be required, following the mitigation hierarchy
- identify any additional surveys required to inform the Ecological Impact Assessment (EcIA)
- identify opportunities offered by the project to deliver biodiversity enhancement

7.9.12 With regard to habitats and vegetation, the PEA will follow the Phase 1 Habitat survey guidelines as set out by the Joint Nature Conservation Committee (Joint Nature Conservation Committee, 2010)[68].

7.9.13 With regard to the Defra *Biodiversity Metric 2.0*, habitats within the indicative DCO boundary will also be assessed using the *UK Habitat Classification* (UK Hab) (Butcher et al., 2020)[69]. Condition assessments will be undertaken in accordance with the technical guidance for the Defra *Biodiversity Metric 2.0*. Where habitats have previously been surveyed using the Phase 1 Habitat survey methodology in 2020, this data will be converted to UK Hab and assigned a condition score using the information collected to date. Where this is not possible, e.g. due to insufficient information, these areas will be resurveyed in 2021 as part of the EIA. In relation to linear habitats, hedgerows/lines of trees will be assessed using the condition assessment guidance for the Defra *Biodiversity Metric 2.0* in addition to the *Hedgerow Survey Handbook* (Department of Environment, Food and Rural Affair, 2007)[70] to assess the ecological criteria of the hedgerows and inform their status as a Habitat of Principal Importance (Joint Nature Conservation Committee, 2008)[71] and/or listed as 'important' according to criteria set under the *Hedgerow Regulations 1997 (as amended)* (Legislation, 1997)[72]. The *MoRPH (River Condition) Assessment* (Modular River Survey, 2020)[73] will be applied for river and stream habitats (see paragraph □).

[67] Chartered Institute of Ecology and Environmental Management (2017) Guidelines for Preliminary Ecological Appraisal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.
[68] Joint Nature Conservation Committee (2010) Handbook for Phase 1 habitat survey - a technique for environmental audit.
[69] Butcher, B., Carey, P., Edmonds, R., Norton, L. and Treweek, J. (2020). The UK Habitat Classification User Manual Version 1.1., UK Hab Ltd.
[70] Department of Environment, Food and Rural Affair (2007) Hedgerow Survey Handbook, A standard procedure for local surveys in the UK. 2nd Edition. Defra, London.
[71] Joint Nature Conservation Committee (2008). Hedgerows UK Biodiversity Action Plan Priority Habitat Descriptions, available at: https://hub.jncc.gov.uk/assets/ca179c55-3e9d-4e95-abd9-4edb2347c3b6#UKBAP-BAPHabitats-17-Hedgerows.pdf [Accessed: 28/11//2020].
[72] Legislation (1997) The Hedgerows Regulations 1997 (as amended), available at: https://www.legislation.gov.uk/uksi/1997/1160/regulation/6/made [Accessed: 28/11/2020].
[73] Modular River Survey (2020) website, available at: https://modularriversurvey.org/

7.9.14 Further surveys for habitats and species will be undertaken where highlighted as required by the desk study and preliminary surveys completed as part of the PEA. These will be undertaken in order to identify the importance of the biodiversity resource and the level of impact through the propose scheme. These shall be undertaken following current published technical guidance and standards. In accordance with the Option Selection stage assessment, the subsequent surveys are expected to include the following terrestrial ecology surveys scoped in with the distance highlighted:

- Scoped within 50m of the indicative DCO boundary – Hedgerows (noting where perpendicular to the boundary, these may extend further than 50m).
- Scoped within 100m of the construction boundary – reptiles, terrestrial invertebrates, bats, badger, red squirrel and water vole.
- Scoped within 250m of the indicative DCO boundary – National Vegetation Classification (NVC), Priority Habitat Assessment, amphibians including great crested newt and otter.
- Scoped within 500m – breeding birds, wintering birds, barn owl.

7.9.15 The distances provided above are considered to represent the zone of influence for the project in terms of the area over which the stated ecological features may be affected by biophysical changes as a result of the proposed project and associated activities. These distances extend from the indicative DCO boundary for example due to species being mobile and/or where there are ecological or hydrological links beyond this. The zone of influence also varies for different ecological features depending on their sensitivity to environmental change.

7.9.16 For the EIA, where required the study area will be extended or surveys for additional ecological receptors not previously identifed at Option Selection stage will be undertaken as a result of the initial PEAs undertaken at each scheme. This may be required in order to incorporate all areas where significant effects could occur on the biodiversity resource throughout the life cycle of the project (for example where great crested newt are recorded and additional waterbodies greater than 250m from the indicative DCO boundary may support the metapopulation dynamics). In addition wider badger surveys may be required in order to investigate clan territories or further investigations into important bat foraging/commuting routes may be required.

Aquatic ecology

7.9.17 Data will be screened to identify any notable or protected species. In addition to the open source aquatic ecology data, a data request (by WFD waterbody) for white-clawed crayfish will be made to the Environment Agency to supplement local records centre searches.

7.9.18 A desk study of available information (supplemented by aquatic habitat walkover surveys, see below and PEA) will be undertaken to identify aquatic habitat meeting the requirements of Priority Habitat and sensitive aquatic habitats. For ponds and ditches identified within the indicative DCO boundary, they will be assessed and subject to detailed surveys if they are considered likely to meet the criteria for Priority Habitat (ponds) or likely to be of high conservation value (ditches).

Surveys

7.9.19 Aquatic surveys will be undertaken to cover all main river corridors relevant to the indicative DCO boundary (indicative sites within 500m of all crossing points unless otherwise stated) as part of the EIA. An initial river habitat assessment will be undertaken to include a fish habitat assessment (Adapted Hendry Cragg-Hine

(Hendry and Cragg-Hine, 1997)[74] methodology) and *MoRPH (River Condition) Assessment*. Detailed surveys will be completed in the vicinity of all new watercourse crossings and where existing watercourse crossings are to be modified/widened. Surveys will characterise the baseline habitat and identify suitable habitats for protected and notable aquatic species (including the qualifying features of the River Eden SAC/SSSI); survey results will be used to determine the need for further aquatic (macroinvertebrate, fish and macrophyte) surveys. These further aquatic surveys will also be undertaken as part of the EIA.

7.9.20 Where sensitive habitats are identified and/or there is potential for significant effects (e.g. Trout Beck Crossing), the river habitat assessment survey length will be extended as appropriate. For the proposed Trout Beck crossing it is proposed that survey will extend to the confluence with the River Eden. This is considered adequate/required to fully understand the baseline aquatic scenario downstream of the proposed crossing.

7.9.21 *Macrophyte surveys* (Water Framework Directive, 2014)[75] and River Corridor Survey (RCS) will be completed in the vicinity of new watercourse crossings and selected existing watercourse crossings (based on habitat assessment). Surveys will characterise the baseline aquatic and riparian vegetation assemblage and identify protected and notable species (including the presence of indicator species for Annex I habitat water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation, a qualifying feature of the River Eden SAC, and other notable aquatic species listed on the River Eden and Tributaries SSSI citation).

7.9.22 Aquatic macroinvertebrate samples (spring and autumn 2021) will be collected in the vicinity of all new watercourse crossings and selected existing watercourse crossings (based on habitat assessment). The survey will characterise the baseline macroinvertebrate assemblage, determine the presence of protected and notable species and inform the assessment of impacts. Where sensitive habitats are identified and/or there is potential for significant effects (e.g. Trout Beck Crossing), an upstream (control) and downstream (impact) sample will be taken to allow future Before-After-Impact-Control (BACI) analysis.

7.9.23 A key aim of the baseline is to understand whether smaller watercourses crossed by the scheme (including tributaries that flow into the River Eden SAC/SSSI) support notable/qualifying species and are functionally linked to the wider catchment. This includes Atlantic salmon, European bullhead, lamprey sp., European eel, brown trout and grayling. As a result of consultation discussions, specific electric fishing survey techniques will be employed for; juvenile salmonids, bullhead and other species; and lamprey in line the with methods prescribed in the JNCC CSM *Guidance for freshwater fauna* (Joint Nature Conservation Committee, 2015)[76]

[74] Hendry, K. & Cragg-Hine, D. (1997) 'Restoration of riverine salmon habitats'. Fisheries Technical Manual 4, Environment Agency, Bristol.
[75] Water Framework Directive (2014) UKTAG River Assessment Method Macrophytes and Phytobenthic, available at: https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Method%20Statements/River%20Macrophytes%20UKTAG%20Method%20Statement.pdf
[76] Joint Nature Conservation Committee (2015) Common Standards Monitoring Guidance for Freshwater Fauna (v. October 2015), available at: https://data.jncc.gov.uk/data/9b80b827-b44b-4965-be8e-ff3b6cb39c8e/CSM-FreshwaterFauna-2015.pdf

7.9.24 White-clawed crayfish surveys will be undertaken in the vicinity of all new watercourse and existing watercourse crossings. The surveys will determine the presence/absence and density of white-clawed crayfish and non-native species.

7.10 Assessment assumptions and limitations

7.10.1 The level of detail regarding design and construction information (compounds, storage areas, welfare units and duration of works), lighting and drainage may be limited intitially and may be subject to change as the project develops. This will be acknowledged in the ES.

Table 7-10: Biodiversity scoping criteria from DMRB *LA 108* - construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) is the project likely to impact designated sites (statutory or non-statutory)?	Y	Y	Y	Y	Y	Y	Y	N	N	Y
2) is the project likely to impact protected or priority habitats?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3) is the project likely to impact protected or priority species?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4) is the project likely to impact the function or quality of habitats?	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
5) is the project likely to impact the conservation status of habitats and species?	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Key Mitigation ***Note: See mitigation summary from ESR for general mitigation (paragraphs 7.7.2 and 7.7.3)***	Woodland planting/ restoration	Woodland, hedgerow and grassland habitat planting/ enhancement. Minimisation of potential for collisions/ mortality (fencing) whilst maintaining connectivity across the A66 for species including badger, bats and riparian/aquatic species (Thacka Beck).	Woodland, hedgerow and grassland habitat planting/ enhancement. Minimisation of potential for collisions/mortality (fencing) whilst maintaining connectivity across the A66 for species including badger, bats and riparian/aquatic species.	At the crossing at Trout Beck the length and design of the bridge will need to be established to avoid adverse impacts on the River Eden SAC and to still allow the river to function naturally within	Scrub/woodland, grassland and hedgerow habitat creation/ enhancement. Minimisation of collisions whilst maintaining connectivity. Appropriate design of new/amended	Replacement scrub/woodland, grassland and hedgerow habitats. Minimisation of collisions whilst maintaining connectivity. Appropriate design of new/amended	Replacement scrub/woodland, grassland and hedgerow habitats. Minimisation of collisions whilst maintaining connectivity. Appropriate design of new/amended watercourse crossings/	Replacement scrub/woodland, grassland and hedgerow habitats. Minimisation of collisions whilst maintaining connectivity. Appropriate design of new/amended watercourse crossings/	Woodland planting/ enhancement.	See mitigation summary and individual schemes* for details. EMP produced in advance of construction. Impacts during construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
			Pollution control measures particularly in relation to drainage features.	the whole floodplain in addition to accommodating the potential for river restoration. Additional habitat creation/ enhancement. Minimisation of collisions whilst maintaining connectivity. Pollution control measures	watercourse crossings. Pollution control measures.	watercourse crossings. Pollution control measures.	channel diversion/ restoration. Pollution control measures.	channel diversion/ restoration. Pollution control measures.		will be controlled through strict adherence to the EMP. Appropriate design of SuDS to maximise biodiversity benefits.
		Additional potential mitigation proposed at Option Selection stage: One bat crossing point to the east of the option alignments consisting of woodland planting.	Additional potential mitigation proposed at Option Selection stage: Two bat crossing points newly planted vegetation) at the crossing of the watercourses. Otter holt construction.	Additional potential mitigation proposed at Option Selection stage: Otter holt construction. Creation/ restoration of river habitat. One pond will be lost. A minimum of two replacement ponds will be required. Three bat crossing points consisting of woodland planting.	Additional potential mitigation proposed at Option Selection stage: Land purchase or land managed to provide additional habitats suitable for birds included within the North Pennine Moors SPA designation Three bat crossing points consisting of woodland planting.	Additional potential mitigation proposed at Option Selection stage: Land purchase or land managed to provide additional habitats suitable for birds included within the North Pennine Moors SPA designation. One bat crossing point consisting of woodland planting.	Additional potential mitigation proposed at Option Selection stage: Two bat crossing points consisting of woodland planting.	Additional potential mitigation proposed at Option Selection stage: Two bat crossing points consisting of woodland planting.		See individual schemes*
Proposed Scope (In)	*1* – Designated Sites River Eden SAC River Eden and Tributaries SSSI	*1* – Designated Sites River Eden SAC River Eden and Tributaries SSSI Yanwath Wood CWS Skirsgill Wood CWS *2* – Habitats	*1* – Designated Sites River Eden SAC River Eden and Tributaries SSSI Whinfell Forest CWS *2* – Habitats	*1* – Designated Sites River Eden SAC and River Eden and Tributaries SSSI	*1* – Designated Sites North Pennine Moors SPA River Eden SAC River Eden and Tributaries SSSI	*1* – Designated Sites North Pennine Moors SPA North Pennine Moors SAC	*1* – Designated Sites Rokeby Park and Mortham Wood LWS	*1* – Designated Sites None identified *2* – Habitats Rivers/Streams, Ponds,	*1* – Designated Sites None identified *2* – Habitats Woodland	See individual schemes*

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
	Skirsgill Wood CWS Yanwath Wood CWS *2* – Habitats Annex 1 habitats associated with River Eden SAC. S41 Habitats Rivers/Streams, Woodland and Hedgerows *3* – Species Birds Bats Badger Red squirrel Amphibians Reptiles Otter Water vole Fish Aquatic invertebrates White-clawed crayfish Terrestrial invertebrates Protected/ notable plants Other mammals Invasive species All species/ habitats TBC following results of updated desk study and surveys.	Annex 1 habitats associated with River Eden SAC. S41 Habitats Rivers/Streams, Woodland, Ponds, and Hedgerows *3* – Species Protected/ notable plants White-clawed crayfish Aquatic Invertebrates Terrestrial Invertebrates Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Red squirrel Other mammals Invasive species	Annex 1 habitats associated with River Eden SAC. Ancient woodland S41 Habitats Rivers/Streams, Woodland, Ponds and Hedgerows *3* – Species Protected/ notable plants White clawed crayfish Aquatic Invertebrates Terrestrial Invertebrates Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Red squirrel Other mammals Invasive species	Temple Sowerby Moss SSSI Chapel Wood CWS Ross Wood CWS *2* – Habitats Annex 1 habitats associated with River Eden SAC. S41 Habitats Rivers/Streams, Woodland, Ponds and Hedgerows Ancient woodland *3* – Species Protected/ notable plants White clawed crayfish Aquatic invertebrates Terrestrial invertebrates Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Red squirrel Other mammals Invasive species	Appleby Fells SSSI Sandford Mire CWS *2* – Habitats S41 Habitats Woodland, Rivers/Streams, Ponds, Lowland fens, Coastal and floodplain grazing marsh, Purple moor-grass and rush pastures *3* – Species Protected/ notable plants White-clawed crayfish Aquatic invertebrates Terrestrial invertebrates Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Red squirrel Other mammals Invasive species	Bowes Moor SSSI Kilmond Scar SSSI *2* – Habitats Annex 1 habitats associated with North Pennines Moors SAC and its associated SSSI components. S41 Habitats: Rivers/Streams, Ponds, Hedgerows, Upland heathland. *3* – Species Protected/ notable plants Aquatic invertebrates Terrestrial Invertebrates White-clawed crayfish Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Other mammals Invasive species	Teesbank Woods, Rokeby LWS *2* – Habitats Ancient woodland S41 Habitats: Rivers/Streams, Hedgerows, Ponds, Woodland, Wood pasture and parkland. *3* – Species Protected/ notable plants White-clawed crayfish Aquatic invertebrates Terrestrial invertebrates Amphibians Reptiles Fish Birds Bats Badger Otter Red squirrel Water vole Other mammals Invasive species	Woodland, Hedgerows Stephen Bank Road Verge (Deleted SINC) *3* – Species Protected/ notable plants Aquatic invertebrates Terrestrial invertebrates White-clawed crayfish Amphibians Reptiles Fish Birds Bats Badger Otter Water vole Red squirrel Other mammals Invasive species	*3* – Species Birds Bats Badger Amphibians Invasive species All species/ habitats TBC following results of updated desk study and surveys	

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Proposed Scope (Out)	*1* – Designated Sites Myers Beck (Mardale Road) CWS (Section 7.8.3). *2* – Habitats Ancient woodland (Table 7-5) *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites Cowraik Quarry LNR (Section 7.8.2) Myers Beck (Mardale Road) CWS (Section 7.8.3) *2* – Habitats Ancient woodland (Table 7-5) *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites Udford Low Moss SSSI (Section 7.8.2) Cowraik Quarry LNR (Section 7.8.2) *2* – Habitats None scoped out at this stage. *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites None scoped out *2* – Habitats None scoped out at this stage *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites Helbeck and Swindale Woods SAC (Section 7.8.2) Helbeck Wood SSSI (Section 7.8.2) Swindale Woods SSSI (Section 7.8.2) Moor House-Upper Teesdale SAC (Section 7.8.2) Swindale Woodland CWS (Section 7.8.3) *2* – Habitats Ancient woodland (>0.5km) Upland Flushes Fens and Swamps (Section 7.8.4) Traditional orchards (Section 7.8.4) *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites None scoped out *2* – Habitats Ancient woodland (Table 7-5) *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites Brignall Banks SSSI (Section 7.8.2) Thorsgill Wood LWS (Table 7-9) *2* – Habitats None scoped out *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites Aske Estate Woodlands SINC (Section 7.8.3) *2* – Habitats Ancient woodland (Table 7-5) *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites None identified *2* – Habitats Ancient woodland (Table 7-5) Rivers and Streams (nearest is 0.7 km) Ponds (nearest is 0.4 km) Traditional orchard (Section 7.8.4) 3 – Species Hazel dormouse (Section 7.8.3) No impacts to habitats which may support white-clawed crayfish, aquatic invertebrates, terrestrial invertebrates, fish, otter, water vole or reptiles.	See individual schemes*

Table 7-11: Biodiversity scoping criteria from *DMRB LA 108* - operation

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) is the project likely to impact designated sites (statutory or non-statutory)?	Y	Y	Y	Y	Y	Y	Y	N	N	Y
2) is the project likely to impact protected or priority habitats?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3) is the project likely to impact protected or priority species?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4) is the project likely to impact the function or quality of habitats?	N	Y	Y	Y	Y	Y	Y	Y	N	Y
5) is the project likely to impact the conservation status of habitats and species?	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Key Mitigation	Ongoing management/maintenance of habitats, appropriate lighting design, ongoing pollution prevention measures relating to road run-off, use of control measures to reduce risk of collisions/mortality i.e. fencing. Monitoring and adaptive management to be implemented where required.									
Proposed Scope (In)	*1* – Designated Sites River Eden SAC River Eden and Tributaries SSSI Skirsgill Woods CWS *2* – Habitats Annex 1 habitats	*1* – Designated Sites River Eden SAC River Eden and Tributaries SSSI *2* – Habitats Annex 1 habitats associated with River Eden SAC.	*1* – Designated Sites River Eden SAC River Eden and Tributaries SSSI Whnfell Forest CWS *2* – Habitats	*1* – Designated Sites River Eden SAC and River Eden and Tributaries SSSI Temple Sowerby Moss SSSI	*1* – Designated Sites North Pennine Moors SPA River Eden SAC River Eden and Tributaries SSSI Sandford Mire CWS	*1* – Designated Sites North Pennine Moors SPA North Pennine Moors SAC Bowes Moor SSSI	*1* – Designated Sites Rokeby Park and Mortham Wood LWS *2* – Habitats S41 Habitats: Rivers/Streams, Hedgerows,	*1* – Designated Sites None identified *2* – Habitats Rivers/Streams, Ponds, Woodland, Hedgerows	*1* - Designated Sites None identified *2* – Habitats Woodland *3* – Species Birds Bats	See individual schemes*

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
	associated with River Eden SAC. S41 Habitats Rivers/Streams, Woodland, Ponds and Hedgerows *3* – Species Birds Bats Badger Red squirrel Amphibians Reptiles Aquatic invertebrates White-clawed crayfish Fish Terrestrial invertebrates Otter Water vole Other mammals Protected/notable plants All species/ habitats TBC following results of surveys.	S41 Habitats Rivers/Streams, Woodland, Ponds, and Hedgerows *3* – Species Protected/ notable plants White-clawed crayfish Aquatic Invertebrates Terrestrial Invertebrates Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Red squirrel Other mammals	Annex 1 habitats associated with River Eden SAC. S41 Habitats Rivers/Streams, Woodland, Ponds, and Hedgerows 3 – Species Protected/ notable plants White-clawed crayfish Aquatic Invertebrates Terrestrial Invertebrates Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Red squirrel Other mammals	Chapel Wood CWS Ross Wood CWS *2* – Habitats Annex 1 habitats associated with River Eden SAC. S41 Habitats Rivers/Streams, Woodland, Ponds and Hedgerows Ancient woodland *3* – Species Protected/ notable plants White-clawed crayfish Aquatic Invertebrates Terrestrial Invertebrates Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Red squirrel Other mammals	*2* – Habitats S41 Habitats Woodland, Rivers/Streams, Ponds, Lowland fens, Coastal and floodplain grazing marsh, Purple moor-grass and rush pastures *3* – Species Protected/ notable plants White-clawed crayfish Aquatic invertebrates Terrestrial invertebrates Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Red squirrel Other mammals	Kilmond Scar SSSI *2* – Habitats Annex 1 habitats associated with North Pennines Moors SAC and its associated SSSI components. S41 Habitats: Rivers/Streams, Ponds, Hedgerows, Upland heathland. *3* – Species Protected/ notable plants Aquatic invertebrates Terrestrial Invertebrates White-clawed crayfish Fish Amphibians Reptiles Birds Bats Badger Otter Water vole Other mammals	Ponds, Woodland, Wood pasture and parkland. *3* – Species Protected/ notable plants White-clawed crayfish Aquatic invertebrates Terrestrial invertebrates Amphibians Reptiles Fish Birds Bats Badger Otter Red squirrel Water vole Other mammals	Stephen Bank Road Verge (Deleted SINC) *3* – Species Protected/ notable plants Aquatic invertebrates Terrestrial invertebrates White-clawed crayfish Amphibians Reptiles Fish Birds Bats Badger Otter Water vole Red squirrel Other mammals	Badger Amphibians Invasive species All species/ habitats TBC following results of updated desk study and surveys.	
Proposed Scope (Out)	1 – Designated Sites Yanwath Wood CWS (Section 7.8.3) Skirsgill Woods CWS (Section 7.8.3) Myers Beck (Mardale Road)	*1* – Designated Sites Cowraik Quarry LNR (Section 7.8.2) Skirsgill Woods CWS (Section 7.8.3) Yanwath Wood CWS (Section 7.8.3) Myers Beck (Mardale Road)	*1* – Designated Sites Udford Low Moss SSSI Cowraik Quarry LNR *2* – Habitats None scoped out at this stage. *3* – Species	*1* – Designated Sites None scoped out at this stage. *2* – Habitats None scoped out at this stage. *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites Helbeck and Swindale Woods SAC (Section 7.8.2) Helbeck Wood SSSI (Section 7.8.2)	*1* – Designated Sites None scoped out at this stage. 2 – Habitats None scoped out at this stage 3 – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites Brignall Banks SSSI (Section 7.8.2) Teesbank Woods, Rokeby LWS (Section 7.8.3) *2* – Habitats:	*1* – Designated Sites Aske Estate Woodlands SINC *2* – Habitats None scoped out at this stage *3* – Species Hazel dormouse (Section 7.8.3)	*1* – Designated Sites None identified *2* – Habitats Ancient woodland (Table 7-5) Rivers and Streams (nearest is 0.7 km)	See individual schemes*

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
	CWS (Section 7.8.3) 2 – Habitats Ancient woodland (Table 7-5) 3 – Species Hazel dormouse (Section 7.8.3) Invasive species (potential impacts associated with construction phase only)	CWS (Section 7.8.3) *2* – Habitats Ancient woodland (Table 7-5) *3* – Species Hazel dormouse (Section 7.8.3) Invasive species (potential impacts associated with construction phase only)	Hazel dormouse (Section 7.8.3) Invasive species (potential impacts associated with construction phase only)	Invasive species (potential impacts associated with construction phase only)	Swindale Woods SSSI (Section 7.8.2) Moor House-Upper Teesdale SAC (Section 7.8.2) Appleby Fells SSSI (Section 7.8.2) Swindale Woodland CWS (Section 7.8.3) *2* – Habitats Ancient woodland (>0.5km) Upland Flushes Fens and Swamps (Section 7.8.4) Traditional orchards (Section 7.8.4) *3* – Species Hazel dormouse (Section 7.8.3) Invasive species (potential impacts associated with construction phase only)	Invasive species (potential impacts associated with construction phase only)	Ancient woodland (>250m) *3* – Species Hazel dormouse (Section 7.8.3) Invasive species (potential impacts associated with construction phase only)	Invasive species (potential impacts associated with construction phase only)	Ponds (nearest is 0.4 km) Traditional orchard (Section 7.8.4) 3 – Species Hazel dormouse (Section 7.8.3) No impacts to habitats which may support white-clawed crayfish, aquatic invertebrates, terrestrial invertebrates, fish, otter,water vole or reptiles. Invasive species (potential impacts associated with construction phase only).	

8 Climate

8.1 Introduction

8.1.1 This chapter outlines the proposed scope of assessment to be undertaken for climate.

8.1.2 In accordance with Design Manual for Roads and Bridges (DMRB) *LA 114 Climate* (Highways England, 2019)[77] the chapter has been divided into the following two subsections:

- Greenhouse Gas (GHG) emissions – reports on the potential additional and avoided GHG emissions associated with the construction and operation of the project, in comparison with current and future baseline GHG emissions. It will also identify measures to reduce the GHG emissions.
- Climate change adaptation – presents how climate change is anticipated to manifest itself in the future and the vulnerability of the project to such climate change. It also evaluates the effectiveness and feasibility of adaptation measures to be integrated into the project to increase the resilience of the project to climate change impacts.

8.1.3 This chapter outlines the proposed scope of assessment to be undertaken for climate for the preferred route.

8.1.4 Climate change also has the potential to influence impacts considered under other disciplines. There will be interrelationships related to the potential effects on climate and other disciplines and it is anticipated that each discipline will consider the potential for climate impacts to influence the impacts identified. Therefore, please also refer to the following chapters and appendices:

- Chapter 6: Air Quality
- Chapter 7: Biodiversity
- Chapter 9: Cultural Heritage
- Chapter 10: Geology and Soils
- Chapter 11: Landscape and Visual
- Chapter 12: Materials and Waste
- Chapter 14: Population and Human Health
- Chapter 15: Road Drainage and the Water Environment
- Appendix A: Major Events

8.1.5 The methodology used will follow the requirements of *DMRB LA 114 Climate* and will reflect the principles of DMRB *GG 103 Introduction and general requirements for sustainable development and design* (Highways England, 2019)[78].

8.2 Key questions for scoping

1. Do you agree with the proposed scope of the climate assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the climate assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?

[77] Highways England (2019a) Climate LA 114, available at: https://www.standardsforhighways.co.uk/dmrb/search/87f12e4f-70f8-4eed-8aed-9e9a42e24183
[78] Highways England (2019b) Introduction and general requirements for sustainable development and design, available at: https://www.standardsforhighways.co.uk/dmrb/search/89d10ef2-7833-44df-9140-df85cd6382b9

3. Is there any baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments?
4. Are there any other key issues or aspects relevant to the climate assessment that you wish to bring to the attention of the design and assessment team?
5. Do you have any feedback on quantifying emissions from habitats and soils lost or degraded through construction of the scheme?
6. Do you have any feedback on the opportunities for mitigating climate impacts?
7. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

8.3 Study area

Greenhouse gas emissions

8.3.1 The study area shall report on the likely additional and avoided GHG emissions for construction and operation. It shall report on the nature and scale of the GHG emissions and the likelihood of significant effects arising from activities associated with the construction of the project within the indicative Development Consent Order (DCO) boundary, and including any temporary land take and compounds. It will also include the emissions associated with the extraction, manufacture and transportation of materials to the construction site, and the management of any wastes arising from construction processes and earthworks within the spatial boundary of the project. In line with *DMRB LA 114* it will consider whether construction GHG emissions (or GHG emitting activity), compared to the baseline scenario (i.e. when compared to GHG emissions and energy use associated with existing maintenance activities), are increased by more than 1%.

8.3.2 The study area for operational emissions from road users will be consistent with the affected road network (ARN) defined within the project traffic model. For the Preliminary Environmental Information (PEI) Report and Environmental Statement (ES), this will draw on existing traffic modelling information from earlier stages of the project. This will be updated based on revised modelling to inform the Environmental Impact Assessment (EIA). The ARN will be defined for the project by applying the scoping criteria included in *DMRB LA 114*, whereby road links are included within the ARN (for climate) where any of the following criteria are met:

- A change of more than 10% in Annual Average Daily Traffic (AADT)
- A change of more than 10% to the number of heavy duty vehicles
- A change in daily average speed of more than 20km/h

8.3.3 *DMRB LA 114* requires consideration of:

- Whether there is (or is likely to be, within the timescales of the assessment) sufficient certainty on the availability of quantitative GHG emissions information.
- Whether the availability of information allows the effects on climate resulting from GHG emissions to be assessed.

8.3.4 It is expected that sufficient information will be available from the preliminary design to allow for a quantification of GHG emissions to inform an assessment of the effects on climate to be assessed as part of the EIA.

Vulnerability to climate change

8.3.5 The study area for assessing the project's vulnerability to climate change shall comprise the indicative DCO boundary, including any temporary land take and construction compounds.

8.3.6 A Flood Risk Assessment (FRA) for the project is being undertaken and will be reported in ES Chapter 15: Road Drainage and the Water Environment. This will take into account Environment Agency allowances for increases in rainfall intensity and peak river flow and considers the increased future risk from both pluvial and fluvial flooding.

8.4 Overview of consultation to date

8.4.1 Table 8-1 identifies the key comments that have been received to date from external consultees on the scope and approach to the climate assessment.

Table 8-1: Climate scope comments to date

Respondent	Comment	How addressed/to be addressed
Natural England, email requesting respondent input dated 4 November 2020	Provided reference information sources on carbon stores and sources in natural habitats.	Information sources will be used to inform the methodology for land use change emissions.
North Yorkshire County Council, email requesting respondent input dated 25 November 2020	Response awaited.	No further action.
Richmondshire District Council, email requesting respondent input dated 25 November 2020	Offered GIS files for historic flooding.	Already in receipt of this data. No further action.
Durham County Council, email requesting respondent input dated 25 November 2020	Response awaited.	No further action.
Highways England, email requesting respondent input dated 12 January 2021	Csv files for A66 flood events and flood hotspots received.	Information will be used to inform historic events baseline for assessment of vulnerability to climate change.
Cumbria County Council, email requesting respondent input dated 6 November 2020	Response awaited.	No further action.
Eden County Council, email requesting respondent input dated 9 November 2020	Response awaited.	No further action.

8.5 Baseline conditions

Historic greenhouse gas emissions

8.5.1 The government has set out a legally binding framework to cut GHG emissions by 100% (net zero) by 2050 under the *Climate Change Act 2008 (as amended)* (Legislation, 2008)[79].

8.5.2 The UK's most recent final GHG emissions national statistics (for 2018) (Government, 2018)[80], set out the total UK GHG emissions for 2018 at 451.5 million tonnes of carbon dioxide equivalents ($MtCO_2e$). UK total emissions are showing a general downward trend, with 2018 UK total GHG emissions down 2% from 460.2 $MtCO_2e$ in 2017. In 2018, the largest emitting sector was transport, accounting for 124.4 MtCO2e, which fell 1% from 2017 to 2018.

8.5.3 The total provisional GHG emissions from transport in the UK are presented in Table 8-2. These figures reflect emissions at point of use, which means that they include direct emissions and do not include emissions resulting from the extraction and production of the fuels used.

Table 8-2: GHG Emissions from transport in UK (Government, 2018)

Year	All transport Million tonnes of CO_2e	Road transport Million tonnes of CO_2e
2013	120.0	107.9
2014	121.3	109.4
2015	123.5	111.6
2016	125.9	114.2
2017	126.1	114.4
2018	124.4	112.9

National greenhouse gas emissions projections

8.5.4 The Department for Business, Energy & Industrial Strategy (BEIS) publishes projections of GHG emissions annually. The main source of historic emissions data is drawn from the *Greenhouse Gas Inventory* (Government, 2020)[81], which is updated each February.

8.5.5 The projections are produced using the BEIS *Energy Demand Model* (EDM) (Department for Business, Energy & Industrial Strategy, 2016)[82]. Projections for

[79] Legislation (2008) Climate Change Act 2008 (as amended), available at: https://www.legislation.gov.uk/ukpga/2008/27/pdfs/ukpga_20080027_en.pdf
[80] Government (2018) Final UK greenhouse gas emissions national statistics: 1990 to 2018, available at: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2018
[81] Government (2020) UK Greenhouse Gas Inventory, 1900 to 2018: Annual Report for submission under the Framework Convention on Climate Change, available at: https://naei.beis.gov.uk/reports/reports?section_id=3
[82] Department for Business, Energy & Industrial Strategy (2016) Energy Demand Model

Transport, under the Reference scenario (Government, 2019)[83] (excluding international aviation and shipping), are presented in Table 8-3.

Table 8-3: Transport Emissions Projections

Year	Transport sector emissions ($MtCO_2e$)
2020	116
2021	114
2022	113
2023	111
2024	110
2025	109
2026	108
2027	107
2028	107
2029	106
2030	105
2031	104
2032	103
2033	103
2034	103
2035	102

8.5.6 The figures in Table 8-3 reflect only emissions from transport vehicles and do not include potential emissions from construction of transport infrastructure, or its subsequent maintenance, repair and replacement during its operational/design life.

8.5.7 Due to the way in which the UK GHG Inventory is assembled and reported, there is no way to identify historic emissions associated with infrastructure construction/maintenance. Similarly there is no forward projection to indicate the scale of this in the future. GHG emissions associated with construction and maintenance of infrastructure are aggregated within broader industry and construction related emissions estimates in the UK GHG Inventory.

Future baseline scenario for GHG emissions

8.5.8 The future baseline (do-minimum) scenario will be identified as part of the analysis, and will include:

- Operational road user emissions for the ARN in the absence of the project
- Operational maintenance emissions for the existing A66 in the absence of the project

8.5.9 The future baseline will incorporate forecast changes to the existing UK fleet mix, and forecast engine efficiency improvements, calculated using the emissions factors provided in the latest (version 3) Highways England speed band emissions factors

[83] Government (2019) Updated energy and emissions projections: 2018, available at: https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2018

spreadsheet (Highways England, 2019c)[84]. Forecasts will be assumed to remain at 2030 levels for the assessment period for the design life of the project beyond 2030.

8.5.10 Under the *Climate Change Act 2008 (as amended)*, the Government is required to set five-yearly carbon budgets, 12 years in advance. The Fifth Carbon Budget, covering the period 2028-2032, was set into legislation on 20 July 2016, prior to the 2050 target amendment and therefore is set in the context of a target of an 80% reduction in GHG emissions by 2050. The UK Climate Change Committee published its recommendations on the Sixth Carbon Budget in December 2020, the Sixth Carbon Budget has been developed in line with the pathway to meeting the UK's new net-zero emissions target in 2050 and includes international aviation and shipping for the first time.

8.5.11 On 21st April 2021, the UK Government laid legislation before Parliament setting out the UK Government's commitments for the Sixth Carbon Budget (which accepted the recommendations from the Climate Change Committee) and which is intended to be set into law by the end of June 2021. There is no current proposal to amend the first five carbon budgets to align with the 2050 target amendment to net zero. The first six National Carbon Budgets are presented in Table 8-4. The Fifth and Sixth Carbon Budgets will be used to contextualise construction and operational emissions. In line with recommendations from the Climate Change Committee the UK Government has commited to reducing emissions by 78% by 2035 under the Nationally Determined Contribution.

Table 8-4: National Carbon Budgets (Government, 2016)[85]

5-year Budget Period	5-year Carbon Budget ($MtCO_2e$)
2013-2017 (Second)	2,782
2018-2022 (Third)	2,544
2023-2027 (Fourth)	1,950
2028-2032 (Fifth)	1,725
2033-2037 (Sixth)	965

Vulnerability to climate change - historic baseline

8.5.12 As outlined in *DMRB LA 114*, the climate change reslience and adaptation assessment will use published historical regional record weather data to assess the current climate change impacts upon the study area. This will include information on recent extreme weather events, to provide an indication on current and past vulnerability.

8.5.13 Historical observed regional weather data is drawn from the *UK regional climate* characteristics reports, published by the Met Office (Met Office, 2020a)[86].

8.5.14 Due to the location and extent of the A66, the route crosses between the North East England and North West England regional climate zones. The baseline therefore varies across the route due to the changing topography and atmospheric conditions.

[84] Highways England (2019c) Air Quality LA 105, available at: https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90
[85] Government (2016a) Carbon budget, available at: https://www.gov.uk/guidance/carbon-budgets
[86] Met Office (2020a) UK regional climates, available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/regional-climates/index

8.5.15 Table 8-5 describes the baseline climate data for the regions associated with the A66 route.

Table 8-5: UK regional historical climate characteristics for the regions of the UK which the A66 intersects, representing the current climate conditions along the A66 route

Parmeter	North West region climate observations	North East region climate observations
Temperature	Temperature over the western region of the study area depends heavily on altitude. Over low-lying areas, mean annual temperatures vary between 9°C and 10.5°C but decrease by 0.5°C for every 100m elevation gain.	The North East region of the UK is surrounded by the coldest waters and contains extensive areas of upland, meaning that temperatures are generally cool throughout the year. Mean annual temperatures vary between 8.5°C and 10°C.
Precipitation	Annual precipitation in the region surrounding the western part of the Project varies significantly between 3200mm per year in the Lake District and 800mm per year in the Eden. The driest season is in spring, whilst the wettest season is in autumn/winter when the Atlantic depressions are at their most vigorous.	Annual precipitation in region surrounding the eastern section of the A66 varies between 1500mm in the Pennines and 600mm towards the East Coast. Seasonal patterns are similar to those for the North West region.
Wind	The western region of the study area is among the most exposed parts of the UK as it is close to the Atlantic and contains large upland areas. The region experiences 5-10 gales per year, defined as days that the wind reaches a mean speed greater than 34 knots over ten consecutive minutes.	The region experiences on average between 5 and 15 gales per year
Sunshine	Sunshine duration is controlled by the length of day and cloudiness. It decreases with increasing altitude, latitude and distance from the coast. Average annual sunshine hours in the western region of the study area range from 1200 hours to 1500 hours.	Average annual sunshine over North East England ranges from 1500 hours near the coast to 1250 hours further inland.
Ground frost	Ground frost refers to a temperature below 0°C measured on a grass surface. In the western region of the study area ground frost occurs on	In the eastern region of the study area, ground frost occurs on average between 80 and 135

Parmeter	North West region climate observations	North East region climate observations
	average between 75 and 150 days per year.	days per year, depending on altitude.
Snowfall	The occurrence of snow is closely linked to temperature. The western region of the study area experiences, on average, between 20 and 50 days of snowfall per year depending on altitude, with an additional 5 days of snowfall for every 100m of elevation gain. Depths of undrafted snow can occasionally reach up to 60cm. When depths of over 15cm occur in association with strong winds, serious drifting can occur and cause widespread travel disruption.	The region surrounding the eastern part of the A66 experiences between 20 and 50 days of snowfall per year depending on altitude. Snow depths are similar to those described for the North West region.

8.5.16 No information is available at present with regards to recent weather patterns and extreme events associated with the A66 route. This is to be updated if we can identify any recent extreme weather data from either the Councils, Environment Agency or from Highways England.

Vulnerability to climate change - future baseline

8.5.17 Future changes to the climate baseline will be identfied for both the construction and operational life cycle stages, and will be used to assess the project's vulnerabliity to future climate change.

8.5.18 All projections (probabilistic, global, regional and local) demonstrate an increased chance of warmer, wetter winters and hotter, drier summers, in addition to an increase in the frequency and intenstiy of extremes of weather.

8.5.19 Under the high emissions scenario, the average warming experienced in the UK could be as high as 5.4^{o}C in summer by 2070, with winters experiencing an increase of 4.2^{o}C.

8.5.20 Precipitation is expected to become more seasonally polarised with wetter winters and drier summers. Under the high emissions scenario, the UK, on average, could experinece a 35% increase in winter precipitation levels and a 47% decrease in summer precipitation levels. However, despite the decrease in overall precipitation volumes, projections indicate an increase in the intensity of heavy summer rainfall events. High or heavy rainfall events are linked to increased surface water on roads and an increased risk of flooding, with associated risk to the project and road user safety.

8.5.21 Climate projections provide projected data in 30 year time periods. The relevant time periods will be used to assess vulnerability to climate change at each life stage of the project (construction and operation). For construction, the 2010-2039 climate projection period covers the period of construction. For operation, the 2070-2099 climate projection period will be used, as this will cover the period to the end of the life of the project.

8.5.22 In accordance with *DMRB LA 114*, the climate projections have been taken from the UK Climate Projections 18 (UKCP18) high emissions scenario representative concentration pathways (RCP) 8.5 (50% probability) 25km probabilistic projections. The baseline data has been taken from the *HadUK-Grid* regional average climate observations for the UK (Met Office, 2020b)[87].

8.5.23 Table 8-6 presents the UKCP18 future projected climate conditions for the areas relevant to the A66 route. UKCP data is provided in 25km grid squares, of which the Project intersects four. It highlights the expected changes in climate conditions, such as the mean temperature and preciptation rates for the 2020s (intended for consideration for construction) and 2080s (intended for consideration for operation). Each parameter (e.g. temperature) is presented as a range to cover the minimum and maximum values from all relevent grid squares, for example the baseline mean winter daily temperature ranges from 2.06°C to 3.18°C across the four grid squares.

Table 8-6: Climate Change Adaptation Projections for the construction and operation periods, based on the UK Climate Projections 18 high emissions scenario (UKCP18, Met Office)

Parameter	Baseline (1981 to 2010)		50th perentile projection for 2020s (2010 to 2039)	50th percentile projection for 2080s (2070 to 2099)
Temperature (°C)	Mean winter daily temperature	2.06 - 3.18	2.78 - 3.89	5.17 – 6.23
	Mean summer daily temperature	12.55 - 13.85	13.34 – 4.65	16.69 - 18.05
	Mean daily winter minimum temperature	-0.52 - 0.15	0.12 - 0.79	2.39 - 3.04
	Mean daily summer maximum temperature	16.28 - 18.55	17.23 - 19.49	20.91 - 23.22
Precipitation rate (mm/day)	Winter mean daily precipitation rate	2.50 - 5.17	2.57 - 5.22	2.89 - 5.69
	Summer mean daily precipitation rate	2.09 - 2.99	2.03 - 2.89	1.53 - 2.30
Number of frost days per year	Days with minimum temperature equal to, or lower than, 0°C	68.3 - 83.3	51.4 - 65.4	8.9 - 25.7*
Number of heatwaves per year	Periods in which two consecutive days have a maximum temperature	0	0 - 0.1	0.3 - 1.8*

[87] Met Office (2020b) HadUK-Grid, available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/data/haduk-grid/haduk-grid

Parameter	Baseline (1981 to 2010)		50th perentile projection for 2020s (2010 to 2039)	50th percentile projection for 2080s (2070 to 2099)
	higher than 29°C and minimum temperature higher than 15°C			
Number of hot days per year	Days in which the maximum temperature exceeds 25°C	1.3 - 3.8	2.8 - 7.7	7.0 - 30.4*
Number of dry spells per year	Periods of 10 or more consecutive days without precipitation	1.5 - 2.4	1.6 - 2.5	1.5 - 3.0*
Number of days per year with heavy rain	Days with more than 25mm precipitation.	3.6 - 7.9	2.0 - 8.6	1.1 - 10.6*
***Projections for 2060-2079 have been used as the Met Office do not currently provide data beyond 2079 for these parameters				

8.5.24 During the construction period (2020s) average winter temperatures (50th percentile) may be as low as 2.78°C with a mean daily minimum temperature of 0.12°C. Winter temperatures are expected to warm throughout the operation period and so winter temperatures experienced during construction are likely to be the lowest temperatures that the route needs to be resilient to. It should be noted that lower emissions scenarios are likely to result in lower winter temperatures than those reported in Table 8-6, however the lower emissions scenarios still show warming against the current baseline.

8.5.25 During operation (up to 2080s) average summer temperatures could increase by over 4°C to 18.1°C. Average summer temperatures may reach 14.7°C with a mean daily maximum temperature of 19.5°C.

8.5.26 Precipitation rates are expected to increase in winter and decrease in summer. The mean precipitation rate could average as much as 5.7 mm/day in winter and as little as 1.5 mm/day in summer.

8.5.27 Using UKCP18 data, additional climate parameters can be modelled, although noting that data is only available up to 2079. This shows that the average number of frost days per year is likely to decrease, but the number of hot days, dry spells and heatwaves is likely to increase during the operational period / assumed design life of the project (60 years).

8.5.28 The number of days per year with heavy precipitation is projected to increase for some sections of the route but decrease for others. Whilst this parameter is not directly linked to the probability of flood events occuring, an increase in the number of days with heavy rainfall is likely to increase flood risk. This data will be used in conjuction with more detailed analysis, such as flood risk assessments, to assess the impact of climate change on flood risk for each section of the route.

8.6 Potential impacts

GHG emissions – construction

8.6.1 The duration of the construction works for the project are expected to be approximately six years and are expected to commence in 2024.

8.6.2 The potential sources of GHG emissions during the construction phase of the project are listed in Table 8-7, reproduced from *DMRB LA 114*.

Table 8-7: Potential GHG emission sources during the construction period

Sub-stage of life cycle	Potential sources of GHG emissions
Product stage; including raw material supply, transport and manufacture	• Embodied GHG emissions associated with the required raw materials. • Vehicle emissions for transportation prior to factory gate. • Industrial and energy emissions in the manufacture of materials.
Construction process stage: including transport to/from works site and construction /installation processes	• Vehicle emissions for transportation of materials to site. • Energy use in construction processes.
Land use change	• GHG emissions mobilised from vegetation or soil loss/degradation during construction phase.

GHG emissions – operation

8.6.3 The design lifetime of the Project is assumed to be 60 years for the purpose of quantifying emissions for this assessment, with the Project opening in 2029.

8.6.4 The potential GHG emissions during the operation phase of the project are listed in Table 8-8, reproduced from *DMRB LA 114*.

Table 8-8: Potential emission sources during the operation of the route

Sub-stage of life cycle	Potential sources of GHG emissions
Use of the infrastructure by the end-user (road user)	• Emissions from vehicles using highway infrastructure
Operation and maintenance (including repair, replacement and refurbishment)	• Energy consumption for infrastructure operation and activities of organisations conducting routine maintenance including extraction, manufacture, transportation and installation energy use.
Land use and forestry	• Ongoing land use GHG emissions/sequestration each year during the lifetime of the infrastructure.

Scoping of GHG emissions assessment

8.6.5 *DMRB LA 114* sets clear scoping requirements for the GHG assessment to determine where further assessment is required. Table 8-9 provides these criteria and a commentary on the consideration of these criteria.

Table 8-9: Application of *DMRB LA 114* Scoping Criteria for GHG assessment

Scoping criteria	Commentary
Construction Are construction GHG emissions (or GHG-emitting activity), compared to the baseline scenario (i.e. when compared to GHG emissions and energy use associated with existing maintenance activities), increasing by >1%?	• Yes, due to the scale of construction required to deliver the project, compared to the do-minimum scenario where the project is not taken forward emissions are expected to increase by more than 1%. • Assessment of Construction emissions should be scoped into the assessment
Operation During operation, will roads meet or exceed any of the following criteria? a) a change of more than 10% in AADT b) a change of more than 10% to the number of heavy-duty vehicles c) a change in daily average speed of more than 20 km/h.	• Yes, the Affected Road Network (see 8.3.2) based on earlier stage modelling indicates that some roads will experience a change of more than 10% AADT. • Assessment of Operational emissions should be scoped into the assessment.

Vulnerability to climate change – construction

8.6.6 Climate change is expected to lead to changes in temperature and weather patterns which have the potential to impact on the construction of the Project:

- During construction, an increase in the frequency of extreme weather events could cause damage and delays, leading to health and safety impact and increased costs.
- Increased temperatures, and prolonged periods of hot, dry weather could exacerbate dust generation and dispersion, leading to health and safety impacts on construction workers.
- Increased precipitation, and intense periods of rainfall, may result in flooding and soil erosion, an increased risk of waterbody contamination, disruption to the supply of materials and goods, and landslides.

8.6.7 The construction period is currently proposed to take place between 2024 and 2029 and could be effected by both summer and winter related climate change impacts.

Vulnerability to climate change - operation

8.6.8 Climate change is projected to increase peak rainfall intensity, and thus increase highway runoff rates and volumes. Flooding in watercourses are similarly expected to increase; therefore scour, bank erosion and exceedance of current minimum future climate design specifications for civil assets will potentially be more likely in the future.

These effects could lead to increased risk of damage and/or requirements for maintenance during operation.

8.6.9 An increase in climatic variability could lead to higher groundwater levels and more saturated soils, but also increased risk of extreme drought. Both impacts can affect ground stability in locations on vulnerable soils. Increased seasonal variability could lead to soil moisture fluctuations and therefore potentially increased risk of shrink-swell related failures.

8.6.10 Vegetation stress due to drought conditions could also be a risk to the infrastructure depending on the width of soft estate, steepened slopes and potential damage to root systems. In addition, increased wind velocities due to climate change are predited. These impacts could result in an increased loss / damage to trees.

8.6.11 Table 8-10 presents the primary weather events currently affecting the study area and provides a high-level overview of the types of potential impacts. These include the impacts idenitified in the Option Selection stage *Environmental Assessment Report (EAR)*[88] and the those specified in *DMRB LA 114*.

Table 8-10: Summary of primary weather events and potential impacts

Primary weather event	Potential impacts
Heavy rain / flooding	• Raised river levels, flooded drains, collapsed culverts • Road closures • Danger to road users • Contaminated water • Fallen trees • Water scour causing structural damage • Weakening or wash out of structural soils • Changes in ground water level and soil moisture
High winds / gales	• Damage to structures from wind borne debris and power cuts • Additional or uneven loading of structures • Fallen trees and damage to landscaping • Disruption and potential danger to crossing users • Road closure • Danger to road users
Increased temperatures and prolonged periods of hot weather	• Health impacts from breathing problems and sunstroke • Danger to road users • Impact to biodiversity • Grass and forest fires • Stress on structures and technology • Challenges from maintenance regimes
Increased frequency of extreme weather events	• Increased requirement for maintenance and repair • Danger to road users • Increased costs

[88] Highways England (2018) A66 PCF Stage 2 Environmental Assessment Report

Primary weather event	Potential impacts
Lightning	• Structural damage • Danger to road users • Power surge and tripping electricity breakers • Fires • Health impacts from direct strikes
Snow and Ice	• Road closure • Danger to road users • Damage to roads • Health impacts from slipping on ice and chest illnesses
Fog	• Danger to road users

8.7 Design, mitigation and enhancement measures

GHG emissions

8.7.1 A comprehensive evaluation of GHG mitigation and enhancement measures was not undertaken as part of the Option Selection stage *EAR*. GHG mitigation and enhancement measures will therefore be identified during the EIA.

8.7.2 In line with *DMRB LA 114*, *"Projects shall seek to minimise GHG emissions in all cases to contribute to the UK's target for net reduction in carbon emissions".* Minimising GHG emissions through design is a core principle of the UK Government's *Infrastructure Carbon Review* (H.M. Tresury, 2013)[89] and the Specification of infrastructure carbon management (PAS 2080) (Bristish Standard Institute, 2016)[90].

8.7.3 In line with the *National Policy Statement for National Networks (NPSNN)* the project design should *"evidence of appropriate mitigation measures (incorporating engineering plans on configuration and layout, and use of materials) in both design and construction should be presented. The Secretary of State will consider the effectiveness of such mitigation measures in order to ensure that, in relation to design and construction, the carbon footprint is not unnecessarily high. The Secretary of State's view of the adequacy of the mitigation measures relating to design and construction will be a material factor in the decision making process"* (Department for Transport, 2014)[91]. The climate assessment team will highlight opportunities to mitigate GHG emissions.

8.7.4 *PAS 2080* looks at the whole value chain, aiming to reduce carbon and reduce cost through more intelligent design, construction and use. *PAS 2080* guidance highlights the importance of early engagement between organisations involved in the delivery of the Project in order to deliver complete transparency and informed specification decisions based on whole-life performance.

[89] H.M. Treasury (2013) Infrastructure Carbon Review, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/260710/infrastructure_carbon_review_251113.pdf
[90] British Standard Institute (2016) Carbon Management in Infrastructure, available at: http://bailey.persona-pi.com/Public-Inquiries/M4%20-%20Revised/8.2.10.pdf
[91] Department for Transport (2014) National Policy Statement for National networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf

8.7.5 Opportunities to mitigate GHG emissions will be developed in line with the hierarchy of mitigation presented in *DMRB LA 114*:

Avoid / prevent

- Maximise potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required, and/or explore alternative lower carbon options to deliver the project objectives (i.e. shorter route options with smaller construction footprints).
- Identify through projects and delivery programmes opportunities to influence user GHG emissions.

Reduce

- Apply low carbon and/or reduced resource consumption solutions (including technologies, materials and products) to minimise resource consumption during the construction, operation and at end of life.

Remediate

- Identify, assess and integrate measures to further reduce carbon through on or off site offsetting or sequestration.

8.7.6 Integration of GHG mitigation in the design process will be based on a generalised carbon management strategy. Examples of measures to minimise embodied emissions from the project include:

- the sustainable reuse of soil and aggregate materials won from excavation.
- the re-use, where possible, of materials and waste generated from construction works, including reuse of excess excavation materials.
- the specification and use of materials with lower embodied carbon, such as those with higher recycled content.
- procurement of locally produced materials where practicable to reduce transportation emissions.
- careful construction management to avoid over-ordering of materials, to reduce transportation emissions.
- implementation of a range of measures through the Environmental Management Plan (EMP) to minimise construction-stage emissions including:
  - Training of construction staff
  - Implementation of travel planning for construction staff
  - Monitoring of construction site impacts (energy use, water use, waste, delivery and transportation record keeping etc.)
  - Powering down of equipment / plant during periods of non-utilisation
  - Optimising vehicle utilisation; use of energy efficient lighting, etc.
  - Implementation of energy saving measures (e.g. minimising the use of diesel- or petrol-powered generators and instead using mains electricity or battery powered equipment)

8.7.7 Opportunities to reduce operation emissions from road users (e.g. supporting the transition to low emissions vehicles) will also be identified and considered.

Vulnerability to climate change

8.7.8 A detailed assessment of mitigation and enhancement measures was not undertaken as part of the Option Selection stage *EAR*. Mitigation and enhancement measures will therefore be identified as part of the EIA.

8.7.9 In line with *DMRB LA 114*, the climate change resilience (CCR) assessment will qualitatively assess the impacts and risks of climate change on the project based on

professional expertise and judgement. The CCR assessment will be composed of three main parts: the identification of climate hazards; the assessment of likelihood and consequences; and the evaluation of significance.

8.7.10 Consideration of mitigation and enhancement measures, including those which have been embedded into the design, will be identified and recorded through the CCR assessment.

8.7.11 The CCR assessment will identify any high or significant risks to the design teams, where the proposed project is vulnerable to climate change. This will inform mitigation and further design of the project.

8.7.12 It is expected that a number of design, maintenance and enhancement measures will be considered as the project progresses into detailed design. These could include:

- Climate resilient design in accordance with best practice planning, design and engineering practice and codes (e.g. UK Government guidance on designing resilient infrastructure (Government, 2016b)[92] and Environment Agency guidance on making allowances for rainfall and flood probability due to climate change (Government, 2020)[93].
- Material specifications which increase the resilience of structures and pavements to higher temperatures and more frequent and intense storm events and flooding. For example, the use of hydraulically bound materials in foundations or the use of reinforcement such as geotextiles.
- Longer vegetation growing seasons leading to a reduction in soil moisture and/or increased tree-leaf coverage.
- Flood mitigation measures, including compensatory floodwater storage, alterations to the locations of embankments, or localised re-profiling of land, in collaboration with the relevant disciplines.

8.8 Description of the likely significant effects

GHG emissions

8.8.1 *DMRB LA 114* guides that the assessment of projects on climate shall only report significant effects where increases in GHG emissions will have a material impact on the ability of Government to meet its carbon reduction targets. *NPSNN* however, states that "*It is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets".*

8.8.2 Construction of the project is likely to require significant quantities of materials to be sourced from within the project area (from earthworks and excavation) and from outside the project area (sourcing of new construction materials for pavements, drainage, structures etc). The construction stage emissions will also include emissions from transportation of materials, waste management, construction processes, and land use change. The scale of these emissions are expected to exceed the thresholds set out in *DMRB LA 114* for scoping, and as such have the potential to be significant and should be considered for further assessment.

8.8.3 The impact of changes to user emissions from vehicles has not been fully assessed as part of the Option Selection stage *EAR*. It is expected that the changes in user emissions will exceed the thresholds set out in *DMRB LA 114* for scoping, and as

[92] Government (2016b) Designing for Infrastructure Resilience, available for: http://bailey.persona-pi.com/Public-Inquiries/M4%20-%20Revised/8.2.10.pdf
[93] Government (2020) Flood risk assessments: climate change allowances, available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

such have the potential to be significant and should be considered for further assessment.

8.8.4 It is not expected that the combined emissions from construction and operation will compromise the ability of the UK to meet its carbon reduction targets, and on this basis these emissions would be considered 'not significant' under the criteria set out in *DMRB LA 114*.

- The construction period for the project will extend to 2029 and will fall within the fifth carbon budget period of 2028-32. The construction stage emissions will be assessed for the significance of project GHG emissions against this budget period.
- Operational emissions will be assessed for the significance of project GHG emissions against the future-most carbon budget available at the time of assessment. The sixth carbon budget (2033-37) will be used for the purpose of assessment for the significance of project operational GHG emissions. Operational emissions will be linearly interpolated between opening year (2029) and the Design Year (2044) to allow for this assessment.

Vulnerability to climate change

8.8.5 In line with *DMRB LA 114*, where the climate change impact on project receptors is potentially significant, a risk assessment shall be undertaken.

8.8.6 The Option Selection stage *EAR* concluded that there are not likely to be any significant effects associated with the vulnerability to climate change in the construction phase as the construction programme is not expected to be long enough to experience any notable changes in the climate.

8.8.7 Even so, extreme weather events are a feature of the baseline climate and projected climate at the time of construction and therefore it is expected that the EMP would be prepared by the appointed contractor and implemented during the construction period. The EMP will include measures such as ensuring construction materials are covered when stored, and pro-active planning undertaken that accounts for the possiblity of extreme weather events, including the use of extreme weather alert systems.

8.8.8 In accordance with *DMRB LA 114*, the significance of an impact on the operation of the project is determined by a combination of its likelihood and consequence. Likelihood is determined by how frequently the impact can be expected to occur and the consequence of the impact is determined by the length of the disruption to normal operation.

8.8.9 The assessment of likelihood, consequence, and resulting measure of significance are set out in *DMRB LA 114* Tables 3.39a to 3.41.

8.8.10 The Option Selection stage *EAR* concludes that there is potential for some of the proposed route's receptors to be adversely affected by climate change. However, the assessment does not apply the significance criteria within the updated *DMRB LA 114* standards. It is therefore considered that there remains the potential for significant impacts relating to vulnerability of the Project to climate change during operation, which should be considered for further assessment.

8.9 Assessment methodology

GHG emissions

8.9.1 A comprehensive assessment of GHG emissions was not undertaken as part of the Option Selection stage *EAR*. In order to align with the requirements of *DMRB LA 114*, GHG emissions will be idenitfied as part of the EIA.

8.9.2 The assessment will report on the likely additional and avoided GHG emissions at each life cycle of the project, in comparison with current and future baseline GHG emissions, based on collection of activity data summarised in Table 8-11. Table 8-11 has been reproduced from *DMRB LA 114*.

Table 8-11: Project lifecycles and associated activity data for GHG assessment

Project life cycle stage	Potential sources of GHG emissions	Expected activity data
Construction	Embodied GHG emissions from materials	Material quantities from design teams
	Emissions from construction activities	Estimated transportation distances, and fuel usage during construction processes
	Land use change	Type and area of land subject to change in usage
Operation	Vehicles using the highways infrastructure	Emissions from vehicles derived from the traffic model and assessment of the ARN
	Energy use and material use for operation of the highway	Typical replacement periods for key materials, and benchmark information on operational energy use
	Ongoing land use emissions/sequestration	Type and area of land subject to change in usage

8.9.3 The GHG assessment will also identify and quantify opportunities for reducing emissions from construction and operation.

8.9.4 *DMRB LA 114* requires use of an industry recognised carbon calculation tool in accordance with the Overseeing Organisation requirements. It is proposed that the Highways England *Carbon Emissions Calculation Tool* (Highways England, 2019c)[94] will be used for this purpose.

8.9.5 The assessment of future operational emissions will include consideration of changes to vehicle efficiency and decarbonisation of the UK vehicle fleet based on Department for Transport forecasts, which reflect changes to the fleet mix (shift from fossil fuels to low carbon vehicles) and engine efficiency improvements up to 2050 (Department

[94] Highways England (2019c) Carbon emissions calculation tool, available at: https://www.gov.uk/government/publications/carbon-tool

for Transport, 2020)[95]. This will be carried out by scaling down vehicle emissions from 2031 in line with these trends.

8.9.6 The GHG assessment will quantify and consider the significance of impacts for:

- Total emissions for the construction of the project between 2024 and 2029
- User emissions for opening year (2029)
- User emissions for the Design Year (2044).

8.9.7 For the purpose of quantifying emissions, an assumed design life 60 years has been used. It is noted that it is very unlikely that the project would be demolished after its design life as the road would have become an integral part of nationally important infrastructure. As per *DMRB LA 114* requirements, decommissioning associated with the project is scoped out of the assessment of climate (for both impacts on climate and vulnerability of projects to climate change) due to the length of the asset's operational phase.

8.9.8 In line with *DMRB LA 114* guidance, GHG emissions will be considered against the relevant Carbon Budget with regards to significance of impacts. GHG emissions from the construction stage of the Project will be considered against the Fifth Carbon Budget. GHG emissions from the operational stage of the Project will be considered against the Sixth Carbon Budget. It is noted that the Design Year is beyond the Sixth Carbon Budget, as is the Project in its operational phase and assumed 60 year design life.

Vulnerability to climate change

8.9.9 As part of the Option Selection stage *EAR* a comprehensive assessment of vulnerability from climate change was not undertaken, and the assessment that was undertaken did not align with the requirements of *DMRB LA 114*. The vulnerability of project receptors to climate change will therefore be assessed as part of the EIA, which will follow the requirements of *DMRB LA 114*.

8.9.10 The CCR assessment is a qualitative assessment which assesses the potential impacts and risks of changes in climate on the Project. The assessment will follow the guidance set out in *DMRB LA 114*.

8.9.11 The Option Selection stage *EAR* concluded that there are not likely to be any significant effects associated with the vulnerability to climate change of the project in the construction phase as the construction programme is not expected to be long enough to experience any notable changes in the climate. It is proposed that the assessment of vulnerability of the project to climate change for the construction stage is scoped out of the EIA for the same reason.

8.9.12 In line with *DMRB LA 114*, the CCR assessment for operation will qualitatively assess the impacts and risks of climate change on the project based on professional expertise and judgement.

8.9.13 The CCR assessment will comprise the following stages:

- Identification of climate hazards
- Assessment of likelihood and consequences
- Evaluation of significance of effect

[95] Department for Transport (2020) Decarbonising Transport, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/932122/decarbonising-transport-setting-the-challenge.pdf

8.9.14 In line with *DMRB LA 114*, the assessment of climate effects on the project will be assessed over an assumed 60-year design life/operational lifecycle.

8.9.15 UKCP18 will be used to provide quantitative estimates of future climatic conditions for the project to inform the assessment.

8.9.16 The potential likelihood and consequence of climate change risks during the operation of the project will be scored using a qualitative five-point scale, based on *DMRB LA 114*.

8.9.17 The historic baseline will be updated to identify available information on historical extreme weather events to identify how the project may have to account for impacts.

8.9.18 The assessment will consider the effect of climate change on temperature and precipitation in the winter and summer seasons, using the UKCP18 high emissions scenario RCP 8.5.

8.9.19 At this stage of the project design, the primary consideration that relates to climate change resilience is from increased flood risk. This may require design changes to mitigate the impacts identified.This will also draw upon inputs from the Road Drainage and the Water Environment assessment team.

8.9.20 Alongside the CCR assessment of vulnerablity to climate change, contractors, design teams and Highways England will be engaged from the start to ensure the potential climate impacts on the project are understood and to encourage that climate resilience is considered in the design of the project.

8.10 Assessment assumptions and limitations

GHG emissions

8.10.1 The assessment of GHG emissions requires the collation of activity data from a range of sources within the design teams, e.g. construction material quantities, transport and plant emissions, etc. It is assumed that such data will be available in sufficient detail to allow the full completion of the Highways England emissions calculation tool to inform the fullest assessment possible. Where there are gaps, professional judgement will be used to adopt appropriate benchmark data (in line with good practice as set out in PAS 2080).

8.10.2 The assessment of user emissions will be based on considering traffic volumes for the ARN. Consideration of the long-term future emissions will require assumptions to be made on likely changes to the future efficiency and carbon intensity of road vehicles, informed by modelled projections.

8.10.3 The ARN was determined based on the regional screening criteria set out in *DMRB LA 114*. Emissions were taken from *DMRB LA 105* screening tool, which are based on the EFT v10 emission factors. For the forecast year emission factors for 2030 have been held constant.

8.10.4 In line with *DMRB LA 114* and practice on comparable projects an assumed study period of 60 years is used for the assessment, noting that the project is not likely to be decommissioned within the study period.

Vulnerability to climate change

8.10.5 Climate projections are simulations of potential future climate scenarios, under a range of hypothetical emissions scenarios and assumptions, and should not be

viewed as predictions or forecasts. Subsequently, the projections used for the assessment should not be viewed as exact or factual, but as probable scenarios.

8.10.6 The assessment will be largely qualitative. Any exceptions to this (carried out under other environmental topics e.g. flood risk modelling, air quality modelling etc.) will be identified in the assessment.

8.10.7 There is limited guidance relating to undertaking climate change resilience assessments in EIA, although examples from other infrastructure projects are becoming more widely available.

8.10.8 The impacts of climate change in relation to road infrastructure will be predominantly informed by professional judgement.

Table 8-12: Climate scoping criteria from *DMRB LA 114* - construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
GHG Emissions 1) are construction GHG emissions (or GHG-emitting activity), compared to the baseline scenario (i.e. when compared to GHG emissions and energy use associated with existing maintenance activities), increasing by >1%?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
GHG Emissions 2) during operation, will roads meet or exceed any of the following criteria? a) a change of more than 10% in AADT; b) a change of more than 10% to the number of heavy duty vehicles; and c) a change in daily average speed of more than 20 km/h.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vulnerability to climate change	N	N	N	N	N	N	N	N	N	N
Key Mitigation	-	-	-	-	-	-	-	-	-	**GHG Emissions** Mitigation and enhancement measures will be identified during the EIA[96]. **Vulnerability to climate change** EMP prepared and implemented during construction[97].
Proposed Scope (In)	-	-	-	-	-	-	-	-	-	**GHG Emissions** Route wide assessment of GHG emissions during the EIA[98]
Proposed Scope (Out)	-	-	-	-	-	-	-	-	-	**Vulnerability to climate change**[99].

[96] In line with *DMRB LA 114*, *PAS 2080* and the mitigation hierarchy.
[97] It is expected that the EMP would be prepared by the appointed contractor and implemented during the construction period to address vulnerability to climate impacts.
[98] The lifetime of the Project is anticipated to be 60 years, with the Project opening in 2031. In line with *DMRB LA 114*, construction GHG emissions have been scoped into the assessment. The GHG emissions associated with the construction of the project will be quantified. The assessment of GHG associated with construction will include embodied carbon emissions from materials, construction activities such as transportation and plant use, and land use change. It is proposed that the Highways England Carbon Emissions Calculation Tool is utilised for the assessment. GHG emissions will be compared against the relevant national carbon budgets to assess significance.
[99] The construction of the project is expected to occur between 2024 and 2029. The expected changes in climate conditions within this period are not anticipated to have a significant effect associated with the vulnerability to climate change during the construction phase of the scheme. It is therefore proposed to scope out the vulnerability of the project to climate change for the construction stage. However, extreme weather events are a feature of the baseline climate and projected climate at the time of construction and therefore it is expected that the EMP would be prepared by the appointed contractor and implemented during the construction period to address vulnerability to climate impacts.

Table 8-13: Climate scoping criteria from *DMRB LA 114* - operation

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
GHG Emissions 1) are construction GHG emissions (or GHG-emitting activity), compared to the baseline scenario (i.e. when compared to GHG emissions and energy use associated with existing maintenance activities), increasing by >1%?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
GHG Emissions 2) during operation, will roads meet or exceed any of the following criteria? a) a change of more than 10% in AADT; b) a change of more than 10% to the number of heavy duty vehicles; and c) a change in daily average speed of more than 20 km/h.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vulnerability to climate change	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Key Mitigation	-	-	-	-	-	-	-	-	-	**GHG Emissions** GHG mitigation and enhancement measures will be identified during the EIA[100]. **Vulnerability to climate change** Mitigation and enhancement measures will be identified during the EIA[101].
Proposed Scope (In)	-	-	-	-	-	-	-	-	-	**GHG Emissions** Routewide assessment of GHG emissions[102].

[100] In line with *DMRB LA 114*, PAS 2080 and the mitigation hierarchy. As part of PCF Stage 3, opportunities to reduce operation emissions from road users (e.g. supporting the transition to low emissions vehicles) will also be identified and considered.
[101] In line with *DMRB LA 114*, best practice planning design, and engineering proactive and codes and EA guidance, material specifications, vegetation and flood mitigation measures.
[102] The lifetime of the Project is anticipated to be 60 years, with the Project opening in 2029. In line with *DMRB LA 114*, operational GHG emissions have been scoped into the assessment. The GHG emissions associated with the operation in the opening year (2029) and design year (2044) will be quantified. The assessment of GHG associated with operational will consider the use of the infrastructure by the end user (i.e. emissions from vehicles using the A66), operation and maintenance (including repair, replacement and refurbishment) and ongoing land use and forestry emissions/sequestration during the lifetime of the infrastructure. It is proposed that the Highways England Carbon Emissions Calculation Tool is utilised for the assessment. As part of PCF Stage 3, opportunities to reduce operation emissions from road users (e.g. supporting the transition to low emissions vehicles) will also be identified and considered. GHG emissions will be compared against the relevant national carbon budgets to assess significance.

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
										Vulnerability to climate change[103]. Routewide assessment of vulnerability to climate change[104].
Proposed Scope (Out)	-	-	-	-	-	-	-	-	-	None

[103] In line with *DMRB LA 114,* the impact of climate change on the operation of the project over a 60-year operational lifecycle will be scoped into the assessment. This will include an identification of climate hazards, risks and benefits, and a qualitative assessment of their likelihood and consequence to inform consideration of significance, in line with *DMRB LA 114* guidance. In accordance with *DMRB LA 114*, the UKCP18 high-emissions scenario (RCP8.5) climate projection data will be used to identify changes, e.g. to winter and summer temperatures and precipitation rates. The assessment will consider the effects of changes in these climate parameters on project assets such as pavements, drainage, geotechnical receptors, and road users.
[104]

9 Cultural Heritage

9.1 Introduction

9.1.1 This chapter details the proposed scope of assessment to be undertaken for cultural heritage.

9.1.2 There may be interrelationships between the potential effects on cultural heritage and other disciplines. Therefore, please also refer to the following chapters:

- Chapter 10: Geology and Soils
- Chapter 11: Landscape and Visual
- Chapter 13: Noise and Vibration

9.1.3 The methodology used will follow the requirements of *DMRB LA 106 Cultural Heritage Assessment* (Highways England, 2020a)[105].

9.2 Key questions for scoping

1. Do you agree with the proposed scope of the cultural heritage assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the cultural heritage assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments?
4. Are there any other key issues or aspects relevant to the cultural heritage assessment that you wish to bring to the attention of the design and assessment team?
5. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

9.3 Study area

9.3.1 The study area is defined according to the sensitivity of the receiving environment and the potential impacts of the project.

Designated resources

9.3.2 The study area considered in the assessment will comprise a buffer that extends 1km from the centreline of each scheme. This buffer has been selected on the basis of professional judgement and experience. This reflects that, by their nature, linear road schemes would sit within a landscape, and are likely to be visible for short stretches of their overall length; as such they are highly unlikely to alter the setting of heritage resources to a degree that would result in either a significant adverse or beneficial effect beyond 1km. The design of the project was reviewed, and it was concluded that it shared these characteristics, and therefore fitted within the expectations of professional judgement.

9.3.3 All designated cultural heritage resources within the study area will be considered within the assessment. In addition, where designated resources such as registered parks and gardens (RPG), straddle the limit of the study area, any designated

[105] Highways England (2020a) Cultural Heritage assessment LA 106, available at: https://www.standardsforhighways.co.uk/dmrb/search/8c51c51b-579b-405b-b583-9b584e996c80

heritage resources that are associated within them that could experience effects will also be included in the assessment.

9.3.4 The noise model and Zone of Theoretical Visibility (ZTV) will be reviewed against known designated heritage resources of very high and high value (Table 9-11) in order to identify any such resources up to 2km from the scheme beyond which distance it is considered that visual or noise changes are unlikely result in an effect on their heritage significance.

Non-designated resources

9.3.5 The assessment will consider non-designated heritage resources within 300m of the indicative Development Consent Order (DCO) boundary. This study area is based upon professional judgement that non-designated resources are less likely to experience significant adverse effects as a result of changes to their settings beyond this distance, following the reasoning described above. This does not preclude non-designated resources being of greater than local importance.

9.4 Overview of consultation to date

9.4.1 Table 9-1 identifies the key comments that have been received to date from external consultees on the scope and approach to the cultural heritage assessment.

Table 9-1: Cultural Heritage Scope Comments to Date

Respondent	Comment	How addressed/To be addressed
Historic England, letter dated 22 December 2020 (ref: PL00586663)	HE noted the importance of a research framework to inform overall understanding of the significance of the historic environment along the route. HE suggested that the research strategy is prepared by someone who is a specialist in the Roman period and with specific knowledge and understanding of the Roman Frontier. The framework should be approached in an iterative manner – with the scope agreed at the beginning of the project, and then updated as new information becomes available.	A research framework will be prepared. The document will be iterative in nature. A recognised expert in the Roman Frontier will provide specialist input to the research framework.
Historic England, letter dated 22 December 2020 (ref: PL00586663)	HE strongly urge that a single geoarchaeological model is commissioned for the project, which incorporates the information from the geotechnical work which will be carried out along the A66. The model should be undertaken by an experienced practitioner, who has undertaken infrastructure work previously.	A two-stage approach is proposed to developing a geoarchaeological model for the A66. In the first instance a high-level review of the state of knowledge will be undertaken, followed by preparation of an interpretative model using data supplied by the

Respondent	Comment	How addressed/To be addressed
		project GI programme when available.
Historic England, letter dated 22 December 2020 (ref: PL00586663)	HE suggested that it may be beneficial to include drainage and fencing requirements as well as site compounds and haul roads.	Section 9.6.8 of this chapter amended to include drainage and fencing (where known).
	It is recommended that temporary construction activity (not simply compounds) should, at a minimum, be assessed if on or near to scheduled monuments.	Temporary construction activity will be assessed wherever it has the potential to impact on any cultural heritage resource.
Historic England, letter dated 22 December 2020 (ref: PL00586663)	HE noted that trial trenching is an evaluative tool which should always, where possible, be used in conjunction with the results of non-intrusive surveys and informed by desk-based assessment.	The trial trenching strategy will be iterative and will be informed by desk-based assessment and non-intrusive survey.
	HE advised that the trial trenching results are included in the ES as early as possible to help inform discussions with stakeholders.	'Live' reporting during trenching will be designed to inform discussions with stakeholders.

9.5 Baseline conditions

9.5.1 Baseline data collated to date comprises:

- Designated heritage resources from Historic England's *National Heritage List for England (NHLE)* (Historic England, 2020)[106] – which contains data for World Heritage Sites (WHS) (and their buffers), Scheduled Monuments, listed buildings, registered park and gardens, and registered battlefields.
- Non-designated heritage resources from the Historic Environment Record(s) (HER) of Cumbria County Council, North Yorkshire County Council and Durham County Council.
- Conservation area data from local authorities.

9.5.2 The HER is not considered to be an exhaustive list of non-designated heritage resources and the data received are therefore subject to amendment based on the findings of, for example, additional desk-based research and/or archaeological walkover. Data concerning locally listed heritage resources (such as historic buildings or parks and gardens of local interest or value which have been identified by local authorities) have also not been included within this baseline. Locally listed assets could, therefore, be reasonably incorporated at such time that they are made available by each local authority.

9.5.3 The NHLE data used within this baseline has been updated since Option Selection stage and is now reflective of Historic England's NHLE data update of 14 August

[106] Historic England (2020) The National Heritage List for England, available at: https://historicengland.org.uk/advice/hpg/heritage-assets/nhle/

2020. The HER data, meanwhile, comprises the datasets obtained during Option Selection stage and will therefore require updating.

9.5.4 A summary of the baseline conditions is provided in Table 9-2 to

9.5.5 Table 9-10 below. Figures 9.1 and 9.2 (in Chapter 18: Figures) show the location of the identified designated heritage resources within the 1km study area for each scheme (Figure 9.1) and non-designated heritage resources within the 300m study area (Figure 9.2). Designated heritage resources located just outside the 1km study area and/or within the 2km ZTV are not shown unless directly relevant to the narrative.

9.5.6 A gazetteer, which concords the Project ID against NHLE and HER references will accompany the Preliminary Environmental Information (PEI) Report as an appendix.

Table 9-2: M6 Junction 40 Baseline Conditions Summary

M6 Junction 40
One hundred and ten designated heritage resources (comprising 103 listed buildings and seven scheduled monuments), six non-designated heritage resources and one conservation area have been identified within the M6 Junction 40 scheme study area. The scheduled monuments include a group of three henges located south of the River Eamont at Mayburgh. Other prehistoric monuments within the scheme study area include a scheduled standing stone and a Bronze Age cairn at Skirsgill. The scheme area is crossed by one of two Roman roads converging on Penrith. The remains of High Street may extend to fall within the DCO footprint Two early medieval scheduled monuments, The Giants Grave and the Giants Thumb, are located in St Andrews Churchyard, Penrith. The medieval buildings at Penrith Castle, Yanwath Hall, and Eamont Bridge are all Grade I listed. Penrith Castle and Eamont Bridge are also scheduled monuments. The majority of listed buildings within the scheme area are located within Penrith Conservation Area. These buildings predominantly date to the eighteenth and nineteenth centuries. The Grade I listed church of St Andrew in Penrith is medieval in origin but rebuilt in the early eighteenth century. Twentieth century monuments include the Penrith Boer War memorial.

Table 9-3: M6 Junction 40 to Kemplay Bank Roundabout Baseline Conditions Summary

M6 Junction 40 to Kemplay Bank Roundabout
There are 59 designated heritage resources (comprising 51 listed buildings and eight scheduled monuments), 21 non-designated heritage resources and one conservation area within the M6 Junction 40 to Kemplay Bank Roundabout scheme study area. Many of these resources also fall within the M6 Junction 40 scheme study area as a result of overlapping study areas. The scheduled monuments include a group of three henges located south of the River Eamont at Mayburgh. Other prehistoric monuments within the scheme study area include an enclosure and a Bronze Age cairn at Skirsgill. Brougham Roman Fort and associated civil settlement are located in the eastern part of the scheme study area. The Roman road, which underlies large sections of the A66, passes close to the fort before crossing the River Eamont and heading towards Old Penrith. The Roman road and the civil settlement fall wholly in the case of the former and partly in the case of the latter within the DCO footprint. The medieval buildings at Penrith Castle, Yanwath Hall, and Eamont Bridge are all Grade I listed. Penrith Castle and Eamont Bridge are also scheduled monuments. Non-designated resources of medieval date also include Eamont Bridge shrunken medieval village, an extensive area of lynchets at Skirsgill and Thacka Beck watercourse. Brougham Castle was built within the remains of the Roman fort in the early thirteenth century. The southern portion of Thacka Beck falls within the DCO footprint. The majority of listed buildings within the scheme study area are located within Penrith Conservation Area. These buildings predominantly date to the eighteenth and nineteenth centuries. Carleton Hall and Carleton Hall Farmhouse (both Grade II* listed) are located adjacent to the proposed route in the eastern part of the scheme. Carleton Hall dates to the early eighteenth century with late eighteenth and twentieth century alterations. Twentieth century monuments include the Eamont Bridge Boer War memorial.

Table 9-4: Penrith to Temple Sowerby (Center Parcs) Baseline Conditions Summary

Penrith to Temple Sowerby (Centre Parcs)
There are 20 designated heritage resources (comprising 13 listed buildings and seven scheduled monuments) and 59 non-designated heritage resources within the Penrith to Temple Sowerby scheme study area. Some of these resources also fall within the M6 Junction 40 to Kemplay Bank Roundabout scheme study area as a result of overlapping study areas. Worked flint fragments of Late Upper Palaeolithic date have been recovered from the area during a recent extensive fieldwalking exercise. These are the earliest prehistoric finds from any scheme across the project. Remote sensing has identified two enclosures of presumed Neolithic date. A beaker burial of Bronze Age date was uncovered during sand quarrying in the nineteenth century. At the western end of the scheme there are extensive remains of Romano-British date at Brougham Roman Fort and the associated civil settlement which extends north and south of the A66. Excavations in advance of road improvements in the 1960s recovered extensive remains of a cemetery of third century date. An earlier marching camp lies to the north-west of the settlement. The Roman road from Scotch Corner to Penrith probably underlies the current A66. The Roman marching camp, fort and associated civil settlements are scheduled. The Roman road and the civil settlement fall wholly in the case of the former and partly in the case of the latter within the DCO footprint. A regionally rare early medieval settlement was uncovered during pipeline work at Fremington in the 1990s. North of the A66 in a bend of the River Eamont lies the site of an early medieval monastery, St Ninian's, now scheduled. The sites of deserted medieval villages lie at St Ninian's and Woodside. Brougham Castle was built within the remains of the Roman fort in the early thirteenth century. A deer park had been established at Whinfell, east of Brougham castle, by 1258. The northern boundary of the park falls within the DCO footprint. St Ninian's church was rebuilt by Ann Clifford c.1660 and is Grade I listed. Ann Clifford also constructed a memorial to her mother, the Countess Pillar and associated Alms Table, adjacent to the A66. Both pillar and alms table are Grade II* listed. The Countess Pillar and Alms Table fall within the indicative DCO boundary.

Table 9-5: Temple Sowerby to Appleby Baseline Conditions Summary

Temple Sowerby to Appleby
This scheme is subject to ongoing assessment of alternative alignment routes There are 44 designated heritage resources (comprising 39 listed buildings and five scheduled monuments), more than 100 non-designated heritage resources and three conservation areas within the study area. The earliest known site in the area is the scheduled Iron Age/Romano British enclosed farmstead at Redlands Bank. This native settlement sits 850m from a temporary Roman camp (also scheduled) and is believed to be broadly contemporary with it. At Kirkby Thore a crossroad is formed by three Roman roads: The Street (now the A66), Maiden Way to the north and the Low Borrowbridge to Kirkby Thore road to the south. Three Roman forts and camps are located within the Temple Sowerby to Appleby area, all of which are scheduled monuments: the Roman fort identified as Bravoniacum located in fields immediately north and east of the Town End of Kirkby Thore; the Roman camp east of Redlands Bank; and the fortlet south-east of Castrigg. Remains of a civilian settlement associated with the fort at Kirkby Thore have been found. The nave walls and south doorway tympanum of the Grade I listed Church of St Margaret and St James, Broom are of pre-conquest date. The parish churches of both Kirkby Thore and Appleby are twelfth century in origin with later additions. The settlements of Temple Sowerby, Kirkby Thore and Crackenthorpe are medieval or earlier in origin. The settlement at Crackenthorpe has shrunk from its medieval extent. Crackenthorpe Hall (Grade II* listed) is predominantly seventeenth century in date. The majority of the listed buildings in the conservations areas of Temple Sowerby and Appleby are eighteenth or nineteenth century in date. Two railway lines of nineteenth century origin run through the scheme area one of which, the Eden Valley line, has been dismantled.

Table 9-6: Appleby to Brough (Warcop) Baseline Conditions Summary

Appleby to Brough (Warcop)
This scheme is subject to ongoing assessment of alternative alignment routes There are 68 designated heritage resources (comprising 62 listed buildings and six scheduled monuments), a minimum of 80 non-designated heritage resources and one conservation area within the Appleby to Brough scheme study area. Groups of Bronze Age barrows are known at Brackenber (scheduled) and Sandford (non-designated). Bronze Age material has been identified at The Druidical Judgement Seat – a D-shaped enclosure defined by a bank and ditch – although the monument is dated to the Iron Age. The A66 broadly follows the alignment of the Roman road except where for a short distance north of Warcop the modern road diverges. A Roman camp (scheduled) is located north of the modern road close to the point at which it diverges. At the eastern end of the scheme lies the Roman fort of Verteris and its associated civil settlement at Church Brough. Brough Castle was built in the northern area of the site of the Roman fort and civil settlement in the late 11th century. An earthwork motte is located at Coupland Beck farm. Moated sites have been identified at Warcop and Easfield Sike. Market Brough was established during the medieval periodand granted a charter to hold a weekly market in the 1330s. Further medieval settlements lay at Warcop and Flitholme (the latter now shrunken from its medieval extent). Extensive evidence of lynchets and ridge and furrow cultivation can be noted throughout the scheme study area. Post-medieval features within the area include structures associated with the Brough to Eamont Bridge turnpike road and the Eden Valley railway.

Table 9-7: Bowes Bypass (A66/A67) Baseline Conditions Summary

Bowes Bypass (A66/A67)
Thirty two designated heritage resources (comprising 28 listed buildings and four scheduled monuments), 31 non-designated heritage resources and one conservation area have been identified within the Bowes Bypass scheme study area. A group of four Bronze Age barrows is located at the western edge of Bowes village. Extensive remains of the Roman fort of Lavatrae and its associated civil settlement are located within the village of Bowes. The Street preserves the route of the Roman road from Penrith to Scotch Corner. Bowes Castle was built in 1171 within the remains of the Roman fort to replace an earlier timber castle. The oldest part of the church of St Giles, also located within the remains of the Roman fort, is of a similar date. The listed remains of a medieval preaching cross are located in a garden on the north side of The Street opposite the church. A possible medieval long house has been identified through aerial photography as a cropmark approximately 160m west of Bowes Castle. The seventeenth century Bowes Hall lies at the eastern end of the village. Annum's Farmhouse and Stonebridge Farmhouse date to the first half of the nineteenth century. Remains of the former Bowes Railway Station, opened in 1861, survive close to the line of the modern bypass.

Table 9-8: Cross Lanes to Rokeby Baseline Conditions Summary

Cross Lanes to Rokeby
This scheme is subject to ongoing assessment of alternative alignment routes Forty-seven designated heritage resources (comprising 46 listed buildings and one scheduled monument), four non-designated heritage resources one registered park and garden, and one conservation area have been identified within the Cross Lanes to Rokeby scheme study area. No monuments of prehistoric date are known within the Cross Lanes to Rokeby scheme study area. The A66 broadly follows the alignment of the Roman road between Penrith and Scotch Corner. A large marching camp has recently been identified from Lidar data within the grounds of Rokeby Park. This camp may be one of a series including the example at Crackenthorpe which are thought to trace the course of the earliest Roman advance across the Pennines. A Roman fort and associated civilian settlement are located at Greta Bridge. A collection of Roman milestones and altars, presumed to have been collected from the surrounding area, is displayed at Rokeby Hall.

Cross Lanes to Rokeby
Settlements are known to have existed at Rokeby and Mortham by the late eleventh century. Rokeby survived into the seventeenth century but Mortham was abandoned in the fourteenth century. Remains of both settlements survive within Rokeby Park. The village of Greta Bridge was founded in the post-medieval period and prospered as a stopping point on the trans-pennine coaching route evidence for which survives in the form of several former inns including the Morrit Arms. The Park at Rokeby was elaborated as part of his development of the Rokeby estate by Sir Thomas Robinson from c.1725. The principal building at Rokeby is Rokeby Hall (Grade I listed). The Rokeby estate is notable for its artistic and literary connections having been visited by Turner, Cottman, Scott, Dickens and Ruskin. The church of St Mary (Grade II* listed) was constructed as the estate church and was consecrated in 1778. The unlisted Old Rectory was built at the same time to house the incumbent. There are a number of listed farmhouses of eighteenth or nineteenth century date, some with associated agricultural buildings, in the scheme area.

Table 9-9: Stephen Bank to Carkin Moor Baseline Conditions Summary

Stephen Bank to Carkin Moor
This scheme is subject to ongoing assessment of alternative alignment routes Five designated heritage resources (comprising four listed buildings and one scheduled monument) and 10 non-designated heritage resources have been identified within the Stephen Bank to Carkin Moor scheme study area. A prehistoric – probably Iron Age – settlement at Carkin Moor has identified through aerial photographs and now forms part the scheduled monument including the Roman fort at Carkin Moor. Lidar survey has indicated the presence of field systems associated with this settlement. The chronological relationship between the Roman fort at Carkin Moor and the adjacent settlement is unknown. However, the fort is bisected by the Roman road and presumably therefore pre-dates it, suggesting an early foundation. Excavations to the west of the fort and south of the A66 suggest the presence of civilian settlement contemporary with the fort. Sections of the Roman road surface were observed. There are the remains of a motte and bailey castle, water defence features, park pale and shrunken medieval village at Ravensworth, two moated sites north of the Old Hall at East Layton, and medieval settlement remains at Hutton Hall. Post-medieval remains include two milestones associated with the turnpiking of The Street in the eighteenth century. A small number of agricultural buildings of eighteenth and nineteenth century date are present in the area.

Table 9-10: A1(M) Junction 53 Scotch Corner Baseline Conditions Summary

A1(M) Junction 53 Scotch Corner
Thirteen designated heritage resources (all listed buildings) have been identified within the A1(M) Junction 53 Scotch Corner area. Excavations in advance of road works north and west of the A1/A66 junction at Scotch Corner have revealed extensive remains of a late- and pre-Roman Iron Age oppidum linked to the nearby sites of Stanwick and Melsonby. The site continued in use after the Roman occupation of the area and developed into a proto-urban settlement which was however largely abandoned by c.AD90. All but two of the listed buildings are located in the village of Middleton Tyas. The majority of the buildings are of eighteenth and nineteenth century date.

9.6 Potential impacts

9.6.1 Prior to implementation of mitigation, the project has the potential to result in beneficial or adverse effects on cultural heritage resources, both during construction and operation.

9.6.2 For the purposes of the cultural heritage assessment, the construction phase is defined as the temporary activities involved in building the project, and the subsequent permanent presence of the project once constructed. The operational phase comprises the situation when the project is being used by traffic.

9.6.3 As listed below, physical impacts upon resources would only occur during the construction phase; impacts upon resources' setting would arise during both the construction and operation phases. Impacts upon setting may be either beneficial or adverse.

Construction

9.6.4 Construction of the project could result in benefits to cultural heritage resources, such as improvements to the settings of heritage resources through screening.

9.6.5 Where the project is contained within the existing road corridor and alongside areas of prior disturbance, the potential for the presence of as-yet unknown archaeological remains would have been previously removed. However, where the project requires excavation below existing ground surface within areas of fields, including compound areas, archaeological remains may ebe present.

9.6.6 Construction of the project has the potential for adverse impacts upon cultural heritage resources, including:

- Partial or total removal of heritage resources, including archaeological remains, within the indicative DCO boundary
- Compaction of archaeological deposits by construction traffic and structures
- Temporary impacts upon the settings of heritage resources
- Permanent impacts upon the setting of heritage resources
- Changes to key views and sight lines
- Impacts to paleoenvironmental deposits as a result of hydrological changes

9.6.7 Where possible, construction impacts would be reduced through design.

9.6.8 Construction activity, including movements of plant, temporary lighting and temporary compounds, fencing and drainage would take place within the wider setting of listed buildings and upstanding non-designated heritage resources within the study area. These works would be temporary, of limited duration and reversible.

9.6.9 Views from heritage resources towards permanent works such as new roads, cuttings, embankments and other structures are considered to be permanent construction impacts for the purposes of the assessment.

Operation

9.6.10 The operational phase of the project has the potential to result in both beneficial and adverse impacts on the setting of cultural heritage resources due to traffic noise and the visibility of moving vehicles on the road. Impacts could include:

- Changes to the settings of monuments
- Changes to key views and sight lines

9.6.11 There would be no physical impacts on below-ground archaeology during operation, as these would have occurred during the construction phase.

9.7 Design, mitigation and enhancement measures

9.7.1 To date, avoidance of direct impacts on nationally important designated assets has been a key consideration and a number of options have been discounted on this basis. However, due to the nature of heritage assets, and the consultation response from Historic England to maintain the historic alignment of the A66, it may not be possible to avoid or mitigate all impacts. Mitigation measures may include:

Design

- Amendments to the project where reasonably practicable during both initial and detailed design
- Preservation in situ using engineering solutions to avoid physical impacts to archaeological remains

Mitigation

- Erecting temporary screening and ensuring that the dust is limited by dampening down the construction area
- Re-routing traffic and reducing the number of deliveries to reduce any impact to heritage resources
- Erecting permanent screening to reduce impacts to the setting of heritage resources
- Archaeological investigations – such as open area excavation or strip, map and sample – to enable the preservation by record of heritage resources

9.7.2 In addition to the listed mitigation methods, best practice construction methods will be implemented as detailed in the Environmental Management Plan (EMP) which may include the requirement for a mitigation strategy if appropriate.

Enhancement

9.7.3 Opportunities for enhancement measures will be investigated as the project design develops.

9.8 Description of the likely significant effects

Construction

9.8.1 At this stage of the assessment a number of potential significant effects have been identified for several heritage resources. Whilst avoidance has been a key focus, there remains the potential for the following significant effects:

- Direct physical impacts to Scheduled Monuments and listed buildings
- Impacts arising from changes in the setting of conservation areas, scheduled monuments and listed buildings
- Direct physical impact on archaeological remains and other currently unknown non designated heritage resources
- Potential direct and/or indirect effects on Rokeby Park RPG
- Potential impacts to the historic context and understanding of the A66 through its re routing
- Potential impacts on historic landscapes

9.8.2 Whilst some elements of mitigation are inherent, such as construction good practices, potential significant effects described below are presented without scheme-specific mitigation due to the current status of the design process. The application of scheme-specific mitigation will aim to avoid or reduce impacts, therefore once this mitigation has been taken into account it is likely that the significance of effects for some resources will be reduced.

M6 Junction 40

9.8.3 This scheme was not assessed at the previous Option Selection stage and, as such work to identify non-designated heritage resourc es was not undertaken. Relevant data is now available and a preliminary assessment of likely effects brought about by this scheme will be undertaken as part of the PEI Report. It is not expected that any resources will experience a significant effect.

M6 Junction 40 to Kemplay Bank Roundabout

9.8.4 The following heritage resources are considered likely to experience significant effects because of this scheme:

- Roman road and enclosures to the south-east of Frenchfield (SM9), moderate adverse (setting)
- Carleton Hall (Cumbria Police Headquarters) (LB148), moderate adverse (setting)
- Carleton Hall Farmhouse (LB154), moderate adverse (setting).

Penrith to Temple Sowerby (Centre Parcs)

9.8.5 The following heritage resources are considered likely to experience significant effects because of this scheme:

- The Countess Pillar (SM7 (also LB86)), large adverse (setting)
- Brougham Roman Fort (Brovacum) and Civil Settlement west of Brougham Castle (SM10), moderate adverse (physical and setting)
- Roman Marching Camp east of Brovacum (SM11), moderate adverse (physical and setting)
- Milestone east of Whinfell Park (LB87), moderate adverse (setting)
- Brougham Ring Ditches (150), moderate adverse (physical).

Temple Sowerby to Appleby

9.8.6 It should be noted that this scheme is currently subject to further alternative alignment routes assessment, in part due to the potential impacts associated with the crossing of Trout Beck. Alternative route alignments under consideration include crossing Trout Beck further to the east, further to the west (closer to Kirby Thore) or a largely online route to the south of Kirby Thore. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected route. Further information on the potential significant effects of this scheme will be presented in the PEI Report in due course.

Appleby to Brough (Warcop)

9.8.7 As with the Temple Sowerby to Appleby section, this scheme is also subject to further alternative alignment routes assessment due to its close interaction with the North Pennines Area of Outstanding Natural Beauty (AONB). Alternative alignments immediately north of Warcop and an alternative tie-in further east along the existing A66 are under consideration. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected route. Further information on the potential significant effects of this scheme will be presented in the PEI Report in due course.

Bowes Bypass (A66/A67)

9.8.8 None of the heritage resources identified within the study area are considered likely to experience significant effects because of the scheme.

Cross Lanes to Rokeby

9.8.9 The following heritage resources are considered likely to experience significant effects because of this scheme:

- Rokeby Rectory (236), large adverse (physical)
- Church of St Mary (LB2), moderate adverse (physical and setting)
- Rokeby Park (RPG1), moderate adverse (setting)
- Milestone 80m east of entrance to Tutta Beck Farm (LB3), moderate adverse (physical and setting)
- Milestone 100m west of junction with B6277 (LB4), moderate adverse (physical and setting).

Stephen Bank to Carkin Moor

9.8.10 The following heritage resources are considered likely to experience significant effects because of the scheme:

- Roman Fort and Enclosed Prehistoric Settlement 400m west of Carkin Moor Farm (SM6), large adverse (physical and setting)

A1(M) Junction 53 Scotch Corner

9.8.11 This scheme was not assessed at the previous Option Selection stage and, as such work to identify non-designated heritage resources was not undertaken. Relevant data is now available and a preliminary assessment of likely effects brought about by this scheme will be undertaken as part of the Environmental Impact Assessment (EIA). It is not expected that any resources will experience a significant effect.

Operation

9.8.12 There is the potential for significant setting effects on heritage resources during operation. These effects are most likely to arise from changes in the setting of the

resource including visual changes from increased traffic movements or changes in noise levels.

M6 Junction 40

9.8.13 This scheme was not assessed at the previous Option Selection stage and, as such work to identify non designated heritage resources was not undertaken. Relevant data is now available and a preliminary assessment of likely effects brought about by this scheme will be undertaken as part of the EIA. It is not expected that any resources will experience a significant effect.

M6 Junction 40 to Kemplay Bank Roundabout

9.8.14 The following heritage resources are considered likely to experience significant effects because of the scheme:

- Roman road and enclosures to the south-east of Frenchfield (SM9), moderate adverse (setting)
- Carleton Hall (Cumbria Police Headquarters) (LB148), moderate adverse (setting)
- Toll Bar Cottage (LB158), moderate adverse (setting).

Penrith to Temple Sowerby (Centre Parcs)

9.8.15 The following heritage resources are considered likely to experience significant effects because of this scheme:

- Settlement 540m east-north-east of Brougham Castle (SM12), moderate adverse (setting)
- Brougham Roman Fort (Brovacum) and Civil Settlement west of Brougham Castle (SM10), moderate adverse (setting)
- Roman Marching Camp east of Brovacum (SM11), moderate adverse (setting)
- The Countess Pillar (SM7 (also LB86)), moderate adverse (setting)
- Alms Table beside Countess Pillar (LB87), moderate adverse (setting).

Temple Sowerby to Appleby

9.8.16 It should be noted that this scheme is currently subject to further alternative alignment routes assessment, in part due to the potential impacts associated with the crossing of Trout Beck. Alternative route alignments under consideration include crossing Trout Beck further to the east, further to the west (closer to Kirby Thore) or a largely online route to the south of Kirby Thore. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected route. Further information on the potential significant effects of this scheme will be presented in the PEI Report in due course.

Appleby to Brough (Warcop)

9.8.17 As with the Temple Sowerby to Appleby section, this scheme is also subject to further alternative alignment routes assessment due to its close interaction with the North Pennines Area of Outstanding Natural Beauty (AONB). Alternative alignments immediately north of Warcop and an alternative tie-in further east along the existing A66 are under consideration. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected route. Further information on the potential significant effects of this scheme will be presented in the PEI Report in due course.

Bowes Bypass (A66/A67)

9.8.18 None of the heritage resources identified within the study area are considered likely to experience significant effects because of the scheme.

Cross Lanes to Rokeby

9.8.19 It should be noted that this scheme is currently subject to further alternative alignments routes assessment. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected alignment route. Further information on the potential significant effects of this scheme will be presented in the PEI Report in due course.

9.8.20 At this stage in the project, none of the heritage resources identified within the study area are considered likely to experience significant effects because of the scheme.

Stephen Bank to Carkin Moor

9.8.21 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected alignment routen. Further information on the potential significant effects of this scheme will be presented in the PEI Report in due course.

9.8.22 Subject to final alignment route selection, the following heritage resource may experience significant effects because of the scheme:

- Roman Fort and Enclosed Prehistoric Settlement 400m west of Carkin Moor Farm (SM6), moderate adverse (setting)

A1(M) Junction 53 Scotch Corner

9.8.23 This scheme was not assessed at the previous Option Selection stage and, as such work to identify non-designated heritage resources was not undertaken. Relevant data is now available and a complete assessment of likely effects brought about by this scheme will be undertaken as part of the EIA. It is not expected that any resources will experience a significant effect.

9.9 Assessment methodology

9.9.1 In addition to compliance with the *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)[107] and *National Planning Policy Framework (NPPF)* (Ministry of Housing, Communities & Local Government, 2019)[108], the assessment will be compiled in accordance with professional standards and guidance. The standards and guidance which relate to this assessment are:

- *Standard and guidance for historic environment desk-based assessment* (Chartered Institute for Archaeologists, 2017)[109]

[107] Department for Transport (2014) National Policy Statement for National Networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf
[108] Ministry of Housing, Communities & Local Government (2019) National Planning Policy Framework, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf
[109] Chartered Institute for Archaeologists (2019a) Standard and guidance for historic environment desk-based assessment, available at: https://www.archaeologists.net/sites/default/files/CIfAS&GDBA_2.pdf

- *Code of Conduct* (Chartered Institute for Archaeologists, 2019)[110]
- *DMRB LA 106 Cultural heritage assessment*
- *DMRB LA 104 Environmental assessment and* monitoring (Highways England, 2020b)[111]
- Good Practice Advice in Planning (GPA2) *Managing Significance in Decision - Taking in the Historic Environment* (Historic England, 2015)[112] – this advice note provides information to support the NPPF and PPG, such as aiding in assessing the significance of heritage assets
- *Good Practice Advice in Planning Note 3 (Second Edition) The Setting of Heritage Assets* (Historic England, 2017)[113] – this advice note sets out a staged approach for assessing the impact of a proposed development on the heritage significance of assets, due to changes in their setting
- *Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment* (Historic England, 2008)[114] – this document sets out the approach to making decisions and offering guidance about all aspects of England's historic environment

Assessment of value

9.9.2 The methodology for assessing effects is based on the principle that the environmental effects of the project, in relation to a single heritage resource (asset), should be determined by identifying the resource's value, assessing the magnitude of change the project would have on the resource's significance (where significance is defined as the attributes that give the resource its value) and then combining these two elements to identify the significance of effect. The following Tables provide further detail on the process for assessing effects.

9.9.3 The value (or importance) of each heritage resource within the study area was determined according to the DMRB criteria set out in *DMRB LA 104* Table 3.2N. Table 9-11 below, is a factor-specific adaptation which has been designed to clarify the generic terms of *DMRB LA 104* Table 3.2N and has previously been adopted by Highways England for use on schemes of a similar size and complexity.

Table 9-11: Value (importance) criteria for heritage resources

Criteria for establishing importance/value of heritage resoruces	
Value	**Typical descriptors**
Very high	Very high importance and rarity, international scale and very limited potential for substitution. Includes World Heritage Sites and nominated sites.
High	High importance and rarity, national scale, and limited potential for substitution. Includes scheduled monuments, listed buildings (all grades), Grade I registered parks and gardens, conservation areas containing very

[110] Chartered Institute for Archaeologists (2019b) Code of Conduct, available at: https://www.archaeologists.net/sites/default/files/CodesofConduct.pdf
[111] Highways England (2020b) Environmental Assessment and Monitoring LA 104, available at: https://www.standardsforhighways.co.uk/dmrb/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a
[112] Historic England (2015) Managing Significance in Decision-Taking in the Historic Environment, Historic Environment Good Practice Advice in Planning Note 2.
[113] Historic England (2017) The Setting of Heritage Assets, Historic Environment Good Practice
[114] Historic England (2008) Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment.

Criteria for establishing importance/value of heritage resoruces	
Value	**Typical descriptors**
	important buildings, undesignated structures of clear national importance, undesignated resources of schedulable quality and importance.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution. Includes conservation areas containing buildings that contribute significantly to historic character, Grade II registered parks and gardens, and non-designated archaeological remains.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.
Very high	Very high importance and rarity, international scale and very limited potential for substitution. Includes World Heritage Sites and nominated sites.

Magnitude of impacts

9.9.4 The approach used to assess magnitude of impacts on heritage resources considers the change upon the receptor. This takes into account the severity of impact of the project, together with the vulnerability of the receptor to change. The approach used is based on professional judgment and experience. It also reflects guidance on 'substantial harm' and 'less than substantial harm' in the *NPSNN* and established methodologies in the DMRB.

9.9.5 The types of impact and magnitude used in the assessment have been adapted from *DMRB LA 104* Table 3.4N and are shown in Table 9-12 below. Table 9-12 is a factor specific adaptation which has been designed to mitigate against the generic terms of *DMRB LA 104* Table 3.4N and has previously been adopted by Highways England for use on schemes of a similar size and complexity.

Table 9-12: Broad criteria for assessing the magnitude of change/impact

Magnitude of impact (change)		Description and nature of change/impact
Major	Adverse	Loss of heritage resource and/or quality and integrity of heritage resource; severe damage to key characteristics, features or elements.
	Beneficial	Large scale or major improvement of heritage resource quality; extensive restoration; major improvement of attribute quality.
Moderate	Adverse	Loss of heritage resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial

Magnitude of impact (change)		Description and nature of change/impact
		impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Significance of effects

9.9.6 By combining the magnitude of impact (or change) and the value (or importance) of each heritage resource, an assessment has been made of the significance of effect, taking into account the possibility and nature of mitigation. The resultant effects may be either negative (adverse) or positive (beneficial) or neutral, depending on the nature of the impact.

9.9.7 In accordance with *DMRB LA 104* Table 3.8.1 Significance Matrix, significance of effect upon the heritage resource is assessed using the matrix in Chapter 5: Environmental Assessment Methodology of this Environmental Scoping Report (ESR).

9.9.8 Where the matrix suggests more than one likely outcome, for instance slight or moderate, professional judgement has been used in conjunction with the descriptors in Table 9-13 to arrive at a robust conclusion.

9.9.9 Table 9-13 below is based upon *DMRB LA 104* Table 3.7, with factor-specific examples of effect replacing the generic statement contained in *DMRB LA 104* Table 3.7, as has previously been adopted by Highways England for use on schemes of a similar size and complexity.

9.9.10 Effects are defined on a nine-point scale (very large beneficial, large beneficial, moderate beneficial, slight beneficial, neutral, slight adverse, moderate adverse, large adverse or very large adverse).

Table 9-13: Assessment criteria

Significance of effect	Descriptor
Very large adverse	Partial or total loss of a resource of the highest value.
Large adverse	Result in the total, or almost total, loss of heritage resources. Be highly intrusive and would seriously damage the setting of the heritage resource such that its significance is totally or almost totally degraded.
Moderate adverse	Be highly intrusive in the setting and as a result adversely affect the significance of the resource. Result in loss of features such that their integrity of the heritage resource is compromised, but not destroyed.

Significance of effect	Descriptor
Slight adverse	Have a detrimental impact on the setting of a heritage resource such that its significance is diminished.
Neutral	Maintain existing historic features in the townscape. Have no appreciable impacts either beneficial or adverse on any known or potential heritage resources. Result in a balance of beneficial and adverse impacts. Not result in severance or loss of integrity context or understanding within a historic landscape. No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.
Slight beneficial	Restore or enhance the sense of place of a heritage feature through good design and mitigation. Remove or mitigate visual intrusion (or other indirect impacts) into the setting of heritage features such as that appreciation and understanding of them is improved. Marginally enhance the integrity understanding and sense of place of a site or group of sites.
Moderate beneficial	Provide potential for significant restoration of characteristic features or their setting through the removal, relocation or mitigation of existing damaging or discordant impacts on the heritage resource. Contribute to regional or local policies for the protection or enhancement of the heritage resource. Enhance the integrity, understanding and sense of place of a site or group.
Large beneficial	Result in the removal, relocation or substantial mitigation of very damaging or discordant existing impacts (direct or indirect) on the heritage. Result in extensive restoration or enhancement of characteristic features or their setting. Form a major contribution to government policies for the protection or enhancement of the heritage resource. Remove or successfully mitigate existing visual intrusion such as that the integrity, understanding and sense of place of a site or group of sites is re-established.
Very large beneficial	As ‘large beneficial’ where the effect would be upon a site of Very High Importance.

9.9.11 Adverse effects of moderate significance or above represent a significant effect that require mitigation.

9.10 Evidence gathering and surveys

9.10.1 In consultation with key stakeholders an evidence gathering and survey strategy will be prepared in support of the assessment.

9.10.2 This will set out the methods to be employed to provide a robust evidence base with information reasonably required to support reasoned conclusions for the assessment.

It will draw on a number of complementary sources and techniques. The techniques employed will include:

- Desk-based assessment
- Geophysical survey
- Remote sensing – including aerial photographic and LiDAR interpretation
- Geoarchaeological modelling
- Trenching
- Setting assessment
- Building assessment

9.10.3 The output from the strategy will be underpinned by an overarching Research Framework.

9.11 Assessment assumptions and limitations

9.11.1 The desk-based baseline will be compiled using heritage asset data obtained from third party sources and the prediction of effects will therefore be based on the accuracy of the data received.

9.11.2 By the very nature of archaeological remains, their identification and assessment necessarily requires an element of assumption. In particular, the nature, extent, survival and even the precise location of buried archaeological remains are often uncertain, as the majority of such sites have never been subject to archaeological investigation to modern standards. Where landowner agreement can be obtained, geophysical survey will be undertaken to identify areas of archaeological potential. These results will be tested by archaeological trial trenching. The trenching will target possible archaeological features and apparent 'blank areas'.

9.11.3 Where it is not possible to undertake geophysical survey and/or trial trenching, professional judgement will be employed to take a precautionary approach to the assessment.

Table 9-14: Cultural Heritage scoping criteria from *DMRB LA 106* - construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) is any designated or other cultural heritage resource in the footprint of the scheme or outside that footprint but still potentially physically affected by it?	N	Y	Y	TBC[115]	TBC[116]	Y	Y	Y	N	
2) is the setting of any designated or other cultural heritage resource in the footprint of the scheme, within the zone of visual influence or potentially affected by noise?[117]	Y	Y	Y	TBC	TBC	Y	Y	Y	N	
3) is there new land take associated with the project?	Y	Y	Y	Y	Y	Y	Y	Y	Y	
4) could potential archaeological remains be concealed?	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Key Mitigation	-	-	Mitigation by design should (1) aim to minimise physical effects on the scheduled Settlement 1/3 mile (540m) ENE of Brougham Castle and (2) remove or minimise impacts on the setting of the listed Countess Pillar and Alms Table	-	-	-	Mitigation by design should aim to (1) remove all physical effects on the Registered Park and Garden at Rokeby and (2) remove or minimise impacts on the setting of the Registered, Park and Garden including those which impact on the non-designated Old Rectory.	Mitigation by design should aim to minimise land take in the vicinity of Carkin Moor Roman Fort and prehistoric enclosed settlement scheduled monument – possibly through use of retaining walls	-	Mitigation by design: (1) avoidance of physical effects on known resources by, for example re-siting of ponds or other scheme elements; or (2) avoidance /minimisation of setting effects by screening and/or good design. Mitigation by record: where physical effects on resources cannot be avoided through the design process a record should be made prior to destruction. The level of the record to be proportionate to the value of the resource. Details of the mitigation to be included in the Environmental Management Plan
Proposed Scope (In)	Slope in	Slope in	Slope in	Slope in	Slope in	Slope in	Slope in	Slope in	Slope in	All schemes at present require new land take. Until there is greater clarity on the location and nature of

[115] This scheme is subject to alternative alignment routes assessment and the inclusion or not of resources within the footprint is still to be determined.
[116] This scheme is subject to alternative alignment routes assessment and the inclusion or not of resources within the footprint is still to be determined.
[117] Noting that setting assessment visits have not been undertaken on any scheme. ZVI mapping is not available for Model Freeze A and reliance has therefore been placed on the mapping created for Stage 2 which does not include Schemes 1 and 11. Noise modelling is likewise limited at this stage.

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
										archaeological remains all schemes should be scoped in. If at a future date the design evolves such that some schemes require no additional land take then physical effects on buried archaeological remains will not be assessed. All schemes at the present design stage have the potential to result in setting impacts. The scale of these impacts cannot be fully determined at this stage. It may be possible at a later stage to identify schemes where the impacts on the setting of heritage resources are negligible or low and the resulting effects not significant.
Proposed Scope (Out)	-	-	-	-	-	-	-	-	-	Nothing is proposed to be scoped out for air quality at this stage.

Table 9-15: Cultural Heritage scoping criteria from *DMRB LA 106* - operation

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) is any designated or other cultural heritage resource in the footprint of the scheme or outside that footprint but still potentially physically affected by it?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2) is the setting of any designated or other cultural heritage resource in the footprint of the scheme, within the zone of visual influence or potentially affected by noise?	Y	Y	Y	Unknown	Unknown	Y	Y	Y	Y	N/A
3) is there new land take associated with the project?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4) could potential archaeological remains be concealed?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Key Mitigation	-	-	-	-	-	-	-	-	-	Mitigation by design should aim to reduce noise and visual intrusion to a minimum.
Proposed Scope (In)	Setting effects - Scope in	Setting effects - Scope in	Setting effects - Scope in	Setting effects - Scope in	Setting effects - Scope in	Setting effects - Scope in	Setting effects - Scope in	Setting effects - Scope in	Setting effects - Scope in	As setting surveys are carried out it is possible that some scheme proposals may be found not to result in operational effects on the setting of heritages resources. The most likely candidates are Bowes Bypass and A1(M) J53 Scotch Corner. At present however all schemes should remain scoped in for assessment of setting effects
Proposed Scope (Out)	Physical effects - Scope out	Physical effects - Scope out	Physical effects - Scope out	Physical effects - Scope out	Physical effects - Scope out	Physical effects - Scope out	Physical effects - Scope out	Physical effects - Scope out	Physical effects - Scope out News	All physical effects on heritage resources will have occurred during construction and as such can be scoped out for operation

10 Geology and Soils

10.1 Introduction

10.1.1 This chapter outlines the proposed scope of assessment to be undertaken for geology and soils.

10.1.2 There may be interrelationships related to the potential effects on geology and soils and other disciplines. Therefore, please also refer to the following chapters:

- Chapter 7: Biodiversity
- Chapter 8: Climate
- Chapter 11: Landscape and Visual
- Chapter 12: Materials and Waste
- Chapter 14: Population and Human Health
- Chapter 15: Road Drainage and the Water Environment

10.1.3 The methodology used will follow the requirements of Design Manual for Roads and Bridges (DMRB) *LA 109 Geology and Soils,* Revision 0 (Highways England, 2019)[118]. The DMRB places the assessment of the loss of peat as a resource in the Material Assets and Waste chapter (see Chapter 12: Materials and Waste) and assessment of the loss of peat on Climate Change in the Climate assessment (Chapter 8: Climate). As a result, the Geology & Soils assessment will not include these aspects, but it will present details of any recorded peat deposits for cross-reference with other chapters. The assessment of impacts due to ground stability is not within the scope of this chapter as these are assessed and mitigated in line with the requirements of *CD 622 Managing geotechnical risk* (Highways England, 2020a)[119].

10.2 Key questions for scoping

1. Do you agree with the proposed scope of the geology and soils assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the geology and soils assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments that you have not already provided?
4. Are there any other key issues or aspects relevant to the geology and soils assessment that you wish to bring to the attention of the design and assessment team?
5. Where the full baseline survey information is unavailable at the time of initial impact assessment, the baseline will need to be based on desk based information and worst-case assumptions – do you have any comments on this approach and the proposed methodology?
6. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

- Study area

[118] Highways England (2019) Geology and Soils LA 109 Revision 0, available at: https://www.standardsforhighways.co.uk/dmrb/search/adca4c7d-4037-4907-b633-76eaed30b9c0
[119] Highways England (2020a) CD 622 Managing Geotechnical Risk, Revision 1, available at: https://www.standardsforhighways.co.uk/prod/attachments/ff5ed991-71ed-4ff2-9800-094e18cd1c4c

10.2.1 The study area for the geology and soils chapter is a 250m buffer either side of the indicative Development Consent Order (DCO) boundary Where sensitive groundwater receptors are present, these will be considered within a 1km buffer of the indicative DCO boundary, in accordance with the study area adopted for the Chapter 15: Road Drainage and the Water Environment assessment. These buffers have been based on professional judgement of the potential impacts posed by the project and is in line with assessments for other major highway and linear infrastructure schemes.

10.2.2 Intrusive preliminary ground investigation and agricultural soil surveys preceding the Environmental Statement (ES) will be targeted within the indicative DCO boundary which will include all temporary land-take areas, as these areas will be directly affected by the project. Where invasive investigative methods are not possible, the use of non-invasive methods will be considered. Although further phases of intrusive ground investigation may be completed to inform detailed design, the information from any such investigations will not be available in time to inform the EIA.

10.2.3 The study area has been based upon professional judgement, and is considered to be appropriate to ensure that any sources of contamination that could migrate and any sensitive receptors that could be affected by the project can be appropriately identified.The increased buffer of 1km for groundwater receptors allows for the potential for greater travel distances of pollutants in deep groundwater. Extension of the study area beyond the 1km buffer may be necessary to capture potential impacts on groundwater quality from significant contamination sources that lie close to the study area boundary, such as large historical landfill sites. A risk-based approach will be taken to the extension of the study area based on the data reviewed.

10.2.4 At this stage, the location of construction compounds is yet to be confirmed. It is considered that the 250m buffer is sufficient to ensure that the likely construction footprint and area of influence of construction compound locations can be appropriately assessed. This assumption shall be reviewed as the project develops and further information becomes available on the location of construction compounds.

10.3 Overview of consultation to date

10.3.1 Table 10-1 identifies the key comments that have been received to date from external consultees on the scope and approach to the geology and soils assessment.

Table 10-1: Geology and soils scope comments to date

Respondent	Comment	How addressed/to be addressed
Environment Agency, response to informal scoping request, letter dated 18 December 2020	• Approach and methodology proposed is considered to be appropriate. • No objection raised to proposed baseline based on desk based information, although requested that all receptors are identified. • Environment Agency identified a small Source Protection Zone (SPZ) 1 within the	• Baseline information is to be supplemented through further enquiries to key stakeholders. • The Zone 1 SPZ is not marked on current baseline data, follow up enquiries will be made with

Respondent	Comment	How addressed/to be addressed
	Stephen Bank to Carkin Moor scheme envelope that had not been included in the baseline.	Environment Agency to identify this SPZ.
Natural England, memo dated December 2020	• Natural England welcomes the use of the assessment methodology set out in *DMRB LA 109*. • Natural England accepts that for the initial scoping a desk based exercise is adequate. • Natural England welcomes the proposal to prepare an Environment Management Plan (EMP) containing soil mitigation measures in line with the Department for Environment, Food & Rural Affairs (Defra) *Construction Code of Practice for the Sustainable Use of Soil on Development Sites* (Department for Environment, Food & Rural Affairs, 2009c)[120].	• *DMRB LA 109* Geology and Soils to be used as the chosen assessment methodology. • Amey/Arup to utilise desk based assessment for initial scoping only. • Amey/Arup to adopt the use of the Defra Code to minimise damage and loss of soil resource.
Durham County Council (DCC), telecon with Senior Contaminated Land Officer on 2 December 2020	• Some sites of potential land contamination have been identified within the study area, including landfilling. Although the risks posed to the end user are low, Made Ground and contamination will need to be identified and dealt with accordingly. • Contaminated Land Officer recommends that pre-construction contaminated land conditions should be imposed to ensure that information compliant with the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG) Guidance (Yorkshire and Lincolnshire	• Potentially contaminated sites identified at baseline. • Proposal to impose pre-commencement planning conditions are noted

[120] Department for Environment, Food & Rural Affairs (2019) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf

Respondent	Comment	How addressed/to be addressed
	Pollution Advisory Group, 2021) is submitted as part of any future planning application for the project, to include a Phase 1 preliminary risk assessment and a Phase 2 site investigation.	
Cumbria County Council (CCC), response to request for information dated 4 December 2020	• No comments provided in response to questions raised by geology and soils topic.	• Have requested clarification to confirm whether further engagement is needed.
Animal and Plant Health Agency (APHA), email dated 17 February 2021	• Confirmed that no recorded animal burial sites are within the study area, but noted that their records are incomplete. • Requested that a formal process is implemented in the event that animal carcasses are discovered during construction.	• Mitigation to be included in EMP, for use in the event that animal burials are encountered during construction.
North Pennines Area of Outstanding Natural Beauty (AONB), telecon February 2020	• Consultation aimed to determine requirements in relation to the United Nations Educational, Scientific and Cultural Organization (UNESCO) Global Geopark designation. • It was confirmed that the AONB designation would take precedence over the Geopark designation.	• No further action at this time.

10.4 Baseline conditions

10.4.1 A summary of the baseline conditions for each proposed scheme making up the project is provided below, generally based upon the conditions identified in the Option Selection stage *Environmental Assessment Report (EAR)* (Highways England, 2018b)[121], supplemented with information obtained subsequently.

10.4.2 The sources of data used are summarised in Table 10-2. Where baseline information was not reported as part of the Option Selection stage *EAR*, for example in relation to geodiversity sites and for the areas of Schemes 1 and 11, a review of readily

[121] Highways England (2018) A66 PCF Stage 2 Environmental Assessment Report

available data was carried out as part of the preparation of this Environmental Scoping Report (ESR), including direct enquiries to stakeholders where possible.

Table 10-2: Summary of baseline conditions references

Baseline category	Source
Geology (superficial deposits and solid geology)	• British Geological Survey (BGS) 1:50,000 scale digital geology (British Geological Survey, 2020a)[122] • Arcadis GIS model set up from BGS data and information supplied in the Envirocheck Report Reference: 169635639 dated 14 June 2018. • Public Health England radon mapping (Public Health England, 2020)[123]
Geodiversity sites (e.g. geological SSSI)	• Defra Multi-Agency Geographic Information for the Countryside (MAGIC) website (Multi-Agency Geographic Information for the Countryside, 2020)[124] • Cumbria geoconservation interactive mapping (Cumbria Biodiversity Data Centre, 2020)[125] • Eden District Council (EDC) *interactive mapping* (Eden District Council, 2020)[126] • North Pennines AONB website (North Pennines, 2020)[127] • UNESCO Global Geopark designation within North Pennines AONB – direct enquiry
Hydrogeology (aquifer designations, abstractions, source protection zones)	• Environment Agency spatial data obtained from *Landmark* (Landmark, 2020)[128] • Environment Agency Information on MAGIC website
Extraction Industries (quarrying and mining)	• BGS Geological Mapping including geology, mineral occurrences and mineral veins • *Historical Ordnance Survey Mapping* (National Library of Scotland, 2020)[129] and *Landmark* • Current Ordnance Survey mapping

[122] British Geological Survey (2020) Geology of Britain viewer, available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[123] Public Health England (2020) radon mapping online, available at: https://www.ukradon.org/information/ukmaps
[124] Multi-Agency Geographic Information for the Countryside (2020) Interactive Map, available at: https://magic.defra.gov.uk/magicmap.aspx
[125] Cumbria Biodiversity Data Centre (2020) Cumbria GeoConservation - Geological Sites Map, available at: https://www.cbdc.org.uk/cumbria_geoconservation_home/cumbrialgs-publicmap/
[126] Eden District Council (2020) Interactive mapping, available at: https://my.eden.gov.uk/myeden.aspx?MapSource=EDC/AllMaps&layers=&StartZoom=80000&StartEasting=351373&StartNorthing=530430
[127] North Pennines (2020) North Pennines Area of Outstanding Natural Beauty, available at: https://www.northpennines.org.uk/unesco-global-geopark/
[128] Landmark (2020) Historical Map Data, available at: https://www.landmarksolutions.co.uk/case-study/historical-map-data
[129] National Library of Scotland (2020) Historical Ordnance Survey Mapping, available at: https://maps.nls.uk/

Baseline category	Source
	• Coal Authority (CA) *Interactive Viewer (Coal Authority, 2020)*[130], including mine entries, abandonment plans, coal outcrops. The CA also hold information on mining on other minerals other than coal. • Highways Agency Geotechnical Data Management System (HAGDMS) • CA - Direct Enquires • British Gypsum (BG) - Direct Enquires • Local Relevant Archives, Carlisle, North Yorkshire and Barrow – Direct Enquires
Soils	• MAGIC website • National Soil Resources Institute (NSRI) Soil Site Reports (National Soil Resources Institute, 2020)[131] • Soils of Northern England 1:250,000 scale (descriptions now on LANDIS, 2016)
Landfills and Waste Activities	• Arcadis geographical information systems (GIS) model set up from Landmark data • Environment Agency spatial data provided by Landmark • BGS Geological Mapping – including BGS recorded Landfills
Potentially contaminative land uses (current and historic) and Pollution Incidents	• National Library of Scotland historical maps • Landmark historical mapping dataset • Arcadis GIS model set up from Landmark data • Foot and Mouth Disease burials from 2001 outbreak – Direct enquiries to the Animal and Plant Health Agency (APHA) and Local Authorities • Part IIA Contaminated Sites – Direct Enquiries and website checks
Unexploded Ordnance (UXO)	• Zetica Risk Maps (Zetica, 2020)[132]

10.4.3 The geology, presence of geodiversity heritage sites, hydrological and hydrogeological setting, soil type and potential land contamination sources (including those associated with landfills, mining and extractive industries and UXO) are summarised for each scheme in

10.4.4 Table 10-3 to Table 10-11.

10.4.5 These should be read in conjunction with Figure 10.1 in Chapter 18: Figures. The provisional value (sensitivity) of the key identified receptors are also identified within the tables, with reference to *DMRB LA 109* for contaminated land receptors and

[130] Coal Authority (2020) Interactive Viewer, available at: http://mapapps2.bgs.ac.uk/coalauthority/home.html
[131] National Soil Resources Institute (2020) Soil site reports, available at: http://www.landis.org.uk/soilscapes/
[132] Zetica Risk Maps (2020) Risk maps, available at: https://zeticauxo.com/downloads-and-resources/risk-maps/

DMRB LA 113 (Highways England, 2020b)[133] for controlled waters receptors (see also Chapter 15: Road Drainage and the Water Environment). These values may be subject to update once detailed assessment information is incorporated into the baseline.

Table 10-3: M6 J40 Penrith baseline conditions summary (not assessed at Option Selection stage)

Feature category	M6 J40 Penrith
Geology	**Superficial geology:** Glacial till (gravelly clays).
	Solid geology: Stainmore Formation comprising cyclical repetition of sandstones, siltstones, mudstones, thin limestones and some coals).
Geodiversity sites	The River Eden and Tributaries Site of Special Scientific Interest (SSSI) (Very high value) passes within the study area to the south of the scheme. Parts of this SSSI are designated as Geological Conservation Review (GCR) sites. These are at Stenkrith Beck, Hilton Beck and the River Belah, all of which fall outside the study area. No geologically designated Local Nature Reserves (LNR) are identified within the study area.
Hydrology and hydrogeology	**Surface watercourses:** River Eamont (Very high value). **Groundwater:** Bedrock: Secondary A aquifer (Medium value). Superficial deposits: Secondary (undifferentiated)/Secondary A aquifers. (Medium value). Located within a Total Catchment (Zone 3) groundwater SPZ (Medium value). Two groundwater abstractions identified (Medium value), at the New Cattle Mart immediately west of the scheme and at Penrith Industrial Estate c. 500m north.
Soils	**Agricultural Land Classification:** Some grade 3a agricultural land (High Value) are present although most of the area contains Urban soils. **NSRI soils data:** Freely draining slightly acid loamy soils belonging to the Wick 1 Soil Association (a group of soil types typically found together in the landscape). Some Newbiggin Association soils are also present.
Potential contamination sources	**Current and historic land uses:** Agricultural land and farms. Cattle market (historical), including above ground storage tank and electricity substation. Cattle market (new). Penrith Industrial Estate. Abbatoir including two tanks.

[133] Highways England (2020b) Road drainage and the water environment LA 113, available at: https://www.standardsforhighways.co.uk/dmrb/search/d6388f5f-2694-4986-ac46-b17b62c21727

Feature category	M6 J40 Penrith
	Depot, including electricity substation. Dismantled North Eastern Railway. Dismantled Penrith Loop Railway. Active railway line. Gravel pit (disused). Civil engineering laboratory and depot. Transport service area, with above ground tanks. Engine shed. Historic railway sidings. Petrol depot and cattle pens. Lime kilns associated with quarry. Timber yard. No recorded pollution incidents identified in the vicinity.
	Extraction industries (mining, quarrying and mineral extraction): Historic gravel pit and quarry identified in the vicinity, both of which appear to have been infilled. The study area is outside of the CA coal mining reporting area. No coal outcrops or mine entries are indicated by the CA interactive map viewer. The superficial deposits at the site have the potential to be quarried at the site.
	Landfills and waste activities: An Environment Agency Historic Landfill is located immediately to the west of the junction at Skirsgill Farm (A McAlpine and Sons). Date of first input of waste was 1968 according to Environment Agency records.
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of World War Two (WWII) bombing. The railway to the west of the study area, however, is indicated to have been a strategic target.

Table 10-4: M6 J40 to Kemplay Bank Roundabout Baseline Conditions Summary

Feature category	M6 J40 to Kemplay Bank
Geology	**Superficial geology:** Glacial till (gravelly clays), glacial fluvial deposits (sands and gravels) and alluvium (clay, silt, sand, gravel and peat).
	Solid geology: Stainmore Formation comprising cyclical repetition of sandstones, siltstones, mudstones, thin limestones and some coals. Penrith Sandstone Formation comprising coarse-grained cross-bedded aeolian sandstone.
Geodiversity sites	The River Eden and Tributaries SSSI (Very high value) is present in the study area. Parts of this SSSI are designated as GCR sites.

Feature category	M6 J40 to Kemplay Bank
	These are at Stenkrith Beck, Hilton Beck and the River Belah, but not within the study area boundary. No geologically designated LNR are identified.
Hydrology and hydrogeology	**Surface watercourses:** River Eamont (Very high value) and tributary Thacka Beck (Medium value). **Groundwater:** Bedrock: Secondary A (Medium value) and Principal aquifers (High value). Superficial deposits: Secondary A aquifer (Medium value). The scheme is located within a Total Catchment (Zone 3) groundwater SPZ (Medium value). Abstraction located within M6 J40 scheme at Penrith New Cattle Mart (Medium value), within 1km of this scheme.
Soils	**Agricultural Land Classification:** Grade 3 agricultural land (High value); these occur throughout the scheme area, concentrated mainly on the southern side of the alignment with the exception of at the eastern end. Urban soils make up the remainder of the area. **NSRI soils data:** Freely draining slightly acid loamy soils belonging to the Wick 1 Soil Association; these cover most of the non-urban parts of the scheme. Some Newbiggin Association soils are also present in the west.
Potential contamination sources	**Current and historic land uses:** Agricultural land and farms. Depot. Historic bleaching mill (now residential). Council depot. 'Heap' (unknown contents). Petrol filling stations. Historic ambulance and fire station. Penrith hospital. New Penrith Fire and Ambulance Station. Potential goods/storage yard. Winters Park landfill. Gravel pit (disused). 'Tip' and Bicycle Motocross (BMX) track. Electricity substations. No pollution incidents have been recorded in the vicinity.
	Extraction industries (mining, quarrying and mineral extraction): A historic gravel pit is shown on historical mapping in the vicinity of the scheme, which is inferred to have since been infilled based on

Feature category	M6 J40 to Kemplay Bank
	observations from aerial imagery. No other current or historic quarries or mines indicated on available maps. Coal resources present at depth. No coal outcrops or mine entries indicated by the CA interactive map viewer. The superficial deposits at the site have the potential to be quarried at the site.
	Landfills and waste activities: A Local Authority Recorded Landfill site is located north of the scheme, named Winters Park. No further information is available for this landfill site.
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of WWII bombing.

Table 10-5: Penrith to Temple Sowerby (Center Parcs) baseline conditions summary

Feature category	Penrith to Temple Sowerby (Center Parcs)
Geology	**Superficial geology:** Glacial till (gravelly clays), glacial fluvial deposits (sands and gravels) and alluvium (clay, silt, sand, gravel and peat).
	Solid geology: Penrith Sandstone Formation comprising coarse-grained cross-bedded aeolian sandstone.
Geodiversity sites	The River Eden and Tributaries SSSI (Very high value) is present to the north of the scheme. Parts of this SSSI are designated as GCR sites. These are at Stenkrith Beck, Hilton Beck and the River Belah (all High value). No geologically designated LNR are identified within the study area.
Hydrology and hydrogeology	**Surface watercourses:** River Eamont (Very high value) and tributaries Light Water tributary (Medium value), Unnamed tributary to River Eamont (Medium value) and Swine Gill tributary to River Eden (Medium value). **Groundwater:** Bedrock: Principal aquifer (High value). Superficial deposits: Secondary A and Secondary (undifferentiated) aquifers (Medium value). Not located within an SPZ. No abstractions identified.
Soils	**Agricultural Land Classification:** Grade 2 and 3 agricultural land (Very High and High to Medium value). Most of the scheme area is Grade 2 with small areas of Grade 3 at Swine Gill and at the eastern end. Most of Grade 3 soils are Grade 3a, with only small areas of Grade 3b. Some non-agricultural soil is also present in the far east. **NSRI soils data:**

Feature category	Penrith to Temple Sowerby (Center Parcs)
	Mainly deep, well drained sandy soils belonging to the Newport 1 Association with some freely draining slightly acid loamy soils of the Wick 1 Association in the north-west.
Potential contamination sources	**Current and historic land uses:** Agricultural land and farms. Historical smithy. Historic tank (covered). Sewage works. Flagstaff Rifle Range (historical). Sheep wash and silo. There is one discharge consent for sewage relating to a domestic property to the north of the scheme.
	Extraction industries (mining, quarrying and mineral extraction): There are no old quarries shown within the study area. Outside of CA coal mining reporting area. The superficial deposits at the site have the potential to be quarried at the site.
	Landfills and waste activities: No historic landfills, waste transfer sites or active landfills have been identified.
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of WWII bombing.

Table 10-6: Temple Sowerby to Appleby Baseline Conditions Summary

Feature category	Temple Sowerby to Appleby
Geology	**Superficial geology:** Glacial till (gravelly clays) and alluvium (clay, silt, sand, gravel and peat).
	Solid geology: Penrith Sandstone Formation comprising coarse-grained cross-bedded aeolian sandstone. Eden Shales comprising red shales and mudstones with beds of gypsum and anhydrite.
Geodiversity sites	The River Eden and Tributaries SSSI (Very high value) is present in the vicinity of the scheme. Parts of this SSSI are designated as GCR sites. These are at Stenkrith Beck, Hilton Beck and the River Belah (all High value). No geologically designated LNR are identified.
Hydrology and hydrogeology	**Surface watercourses:** River Eden (Very high value), Trout Beck (Very high value) and unnamed tributaries of the River Eden (Medium value).

Feature category	Temple Sowerby to Appleby
	Groundwater: Bedrock: Principal (High) and Secondary B aquifers (Medium value). Superficial deposits: Secondary A and Secondary (undifferentiated) aquifers (Medium value). Not located within an SPZ. Six groundwater abstractions have been identified, four of which relate to the BG works to the north of the scheme and two relate to agricultural use (Medium value).
Soils	**Agricultural Land Classification:** Grade 2 (central and western areas), Grade 3 (in the east and on northern part of the proposed bypass north of Kirkby Thore. Some urban land exists in the east). (Very High to Medium value). **NSRI soils data:** The soils in the western parts of this section are mapped as being slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils belonging to the Clifton Association (a group of soil types typically found together in the landscape). The River Eden and Trout Beck floodplains are associated with loamy and clayey floodplain soils with naturally high groundwater (belonging to the Enborne Association). The eastern section is associated with freely drained slightly acid loamy soils (belonging to the Wick 1 Association).
Potential contamination sources	**Current and historic land uses:** Agricultural land use and farms. Dismantled railway and disused station. Areas of infilled ground, artificially modified ground and made ground. Sewage treatment works. Garage/haulage yard. Petrol filling station. Kirkby Thore Works landfill (BG works), two authorized landfills and three historical landfills. Disused quarries. Old lime kilns. Coal/lignite discharge consent. Wood processing works. Railways (active) and sidings. Discharge consents (sewage, food and non-water). Stamphill Mine and adit. Scrapyards. No recorded pollution incidents have been identified in the vicinity of this Scheme.
	Extraction industries (mining, quarrying and mineral extraction): Historic quarries and mining are indicated in the study area and wider area.

Feature category	Temple Sowerby to Appleby
	Current underground extraction of gypsum is indicated in area by BG at Longriggs Mine. Coal seams are present at depth. No coal outcrops or coal mine entries indicated by CA interactive map viewer. However, Stamphill Mine and adit are shown on historical mapping in the vicinity of the scheme. The superficial deposits at the site have the potential to be quarried at the site.
	Landfills and waste activities: Two authorized landfill sites are present in the vicinity of the scheme, associated with the BG works. One of the landfills has a date of first waste input in 1978 and has closure status; the other landfill (Kirkby Thore Works landfill) was licensed in 2020, assumed to be still active. Three historic landfills are also present in the vicinity of the scheme associated with the BG works. These were used from 1949 onwards. Further information is provided below: The earliest recorded historical landfill is listed as having first input waste in 1949, with a date of last input in 1968. Aerial imagery shows the area has been restored. The second landfill has a date of first input in 1968 with waste comprising industrial and inert, but no date of last input is provided. Aerial imagery shows the area has been restored. The third landfill was licensed in 1997, with no date of final input provided.However, satellite imagery suggests this landfill is within the footprint of the active Kirkby Thore Works landfill.
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of WWII bombing.

Table 10-7: Appleby to Brough (Warcop) baseline conditions summary

Feature category	Appleby to Brough (Warcop)
Geology	**Superficial geology:** Glacial till (gravelly clays) and alluvium (clay, silt, sand, gravel and peat).
	Solid geology: Penrith Sandstone Formation comprising coarse-grained cross-bedded aeolian sandstone.
Geodiversity sites	The North Pennines AONB, designated as a UNESCO Global Geopark, present throughout the scheme to the north of the existing A66 (Very high value). No geological SSSI are identified in the study area. No geologically designated LNR are identified within the study area.

Feature category	Appleby to Brough (Warcop)
Hydrology and hydrogeology	**Surface watercourses:** River Eden (Very high value) and tributaries Scandal Beck to Lyvennet (High value), Lowgill Beck (High value), tributaries of Crooks Beck, including Hayber Beck and Moor Beck (Medium value). **Groundwater:** Bedrock: Principal aquifer (High value). Superficial deposits: Secondary A and Secondary (undifferentiated) aquifers (Medium value). Not located within an SPZ. Three abstractions have been identified in the vicinity of the scheme; two relating to agricultural use (Medium value) and one used for private drinking water supply (Very high value).
Soils	**Agricultural Land Classification:** Grade 3 High and Medium Value (across most of this scheme) and Grade 4 (Low Value) agricultural land in the western side of the scheme area, north of the A66 highway. Some non-agricultural soils are shown in the vicinity of MOD property, and urban soils are present in the centre and west. **NSRI soils data:** Freely draining slightly acid loamy soils belonging to the Wick 1 Soil Association (a group of soil types typically found together in the landscape), also Crannymoor, well drained sandy soils, affected by groundwater and some Clifton Association soils: these are slowly permeable clayey soils
Potential contamination sources	**Current and historic land uses:** Agricultural land use. Warcop Training Centre (Ministry of Defence (MoD) facility) to south of A66, including MTFI (Mechanical Transport Fuelling Installation) above ground fuel storage tanks (heating) and Warcop Training Ground to north of A66 including garage/maintenance facilities and firing ranges. Eden Valley Railway. Depot. Above ground storage tank. Sawmill. Coal depot and goods shed. Sewage works. Discharge consent (sewage). Slurry pond. Historic gravel pit. Two pollution incidents showing no impact to air (category 4), minor impact to land (category 3), and significant impact to water to water (category 2). Incident located at Lowgill Beck on 31/05/2004. Operational waste treatment site.

Feature category	Appleby to Brough (Warcop)
	Local authority recorded landfill sites. Garage and waste oil transfer.
	Extraction industries (mining, quarrying and mineral extraction): A historical gravel quarry has been identified from historical mapping. No mine entries identified from current or historical maps. Coal seams present at depth, but outside of CA mining reporting area. The superficial deposits at the site have the potential to be quarried at the site.
	Landfills and waste activities: A registered waste treatment site and licensed waste management site are present in the vicinity of the scheme. Two Local Authority recorded landfill sites are present in the vicinity of the scheme comprising Brough Mill and Musgrave Lane.
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of WWII bombing. Limited information is currently available regarding the risk of ordnance associated with Warcop MoD training facility. Firing ranges are identified within the Warcop Training Ground.

Table 10-8: Bowes Bypass (A66/A67) Baseline Conditions Summary

Feature category	Bowes Bypass (A66/A67)
Geology	**Superficial geology:** Glacial till (gravelly clays) and localised Peat.
	Solid geology: Stainmore Formation comprising cyclical repetition of sandstones, siltstones, mudstones, thin limestones and some coals. Great Limestone Member Limestone comprising Carbonate material (coral, shell fragments). Alston Formation comprising Bioclastic limestones, sandstones, mudstones, siltstones and rare coals. Four Fathoms Limestone comprising Carbonate material (coral, shell fragments).
Geodiversity sites	The North Pennines AONB, designated as a UNESCO Global Geopark, extends into the far west of this scheme (Very high value). No geological SSSI are identified in the vicinity of the scheme. No geologically designated LNR are identified in the vicinity of the scheme.
Hydrology and hydrogeology	**Surface watercourses:** River Greta (High value), Chert Gill (Medium value) and five unnamed tributaries (Medium value).

Feature category	Bowes Bypass (A66/A67)
	Groundwater: Bedrock: Secondary A aquifers (Medium value). Superficial deposits: Secondary (undifferentiated) aquifer (Medium value). Not located within an SPZ. No abstractions identified.
Soils	**Agricultural Land Classification:** Within this scheme, Grade 3b to 4 agricultural land (Medium to Low value) exists with areas of Urban classification around the village of Bowes and the Low Field area to the east. A small area of non-agricultural land is present at the eastern end beside a Hulands quarry. **NSRI soils data:** Soils in west mapped as slowly permeable seasonally wet acid loamy and clayey soils (belonging to the Brickfield 3 Association). Soils in east mapped as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (belonging to the Dunkeswick Association).
Potential contamination sources	**Current and historic land uses:** Agricultural land and farms. Active limestone quarry (Hulands Quarry). Disused limestone quarries (Barf Hill, Clint Quarry, Kilmondwood Quarry, North Side and un-named). Disused railway station and railway lines. Cemetery. North Eastern Railway. Hulands landfill (inert). Transport depot (disused). Garage. Potential storage tank. Smithy (historical).
	Extraction industries (mining, quarrying and mineral extraction): Five historic and one active quarries shown in the vicinity of the scheme, Including Hulands and North Side quarries, both of which show tunnels beneath the current A66, outside of the current proposed scheme. These may have since been infilled. Permission was granted for Hulands quarry to be extended in 2009, although it is not known if this was undertaken. Planning information suggests it is expected to close in 2024 and will be remediated. Hulands Quarry (CL07-15) is present on historical mapping from 1893 until 1976 where its labelled as disused. The ‘disused’ label has been removed from recent OS mapping. Coal seams present at depth, but the scheme is outside of the CA mining reporting area. The superficial deposits at the site have the potential to be quarried.

Feature category	Bowes Bypass (A66/A67)
	Landfills and waste activities: Environment Agency data reports that Hulands Landfill (CL07-16) was operated from 1991 to 1992 to the immediate north of the A66 and received inert waste. It is understood this refers to the same quarry that received an extension planning permission in 2009.
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of WWII bombing. A military strategic target is, however, identified north-west of Bowes within 500m of the alignment.

Table 10-9: Cross Lanes to Rokeby baseline conditions summary

Feature category	Cross Lanes to Rokeby
Geology	**Superficial geology:** Glacial till (gravelly clays) and alluvium (clay, silt, sand, gravel and peat).
	Solid geology: Great Limestone Member Limestone comprising Carbonate material (coral, shell fragments). Alston Formation comprising Bioclastic limestones, sandstones, mudstones, siltstones and rare coals.
Geodiversity sites	No geological SSSI are identified in the study area. No geologically designated LNR are identified within the study area.
Hydrology and hydrogeology	**Surface watercourses:** River Greta (High value), Chert Gill (Medium value) and five unnamed tributaries (Medium value). **Groundwater:** Bedrock: Secondary A aquifers (Medium value). Superficial deposits: Secondary (undifferentiated) aquifer (Medium value). Not located within an SPZ. No abstractions identified.
Soils	**Agricultural Land Classification:** Within this scheme, Grade 3 agricultural land (High to Medium value) exists. Grade 3a (Medium Value) exists in the western edge only, with the remainder Grade 3a. Rare small patches of Urban soil is present locally, associated with roads and buildings **NSRI soils data:** The soils are mapped as freely drained slightly acid loamy soils belonging to the Wick 1 Association (a group of soil types typically found together in the landscape).

Feature category	Cross Lanes to Rokeby
Potential contamination sources	**Current and historic land uses:** Agricultural land uses, including a poultry house. Smithy. Cemetery. Potential fly tipping (identified from aerial imagery). Discharge consents (food), relating to a café at Cross Lanes and a hotel at Greta Bridge. Potential scrapyard and tanks (identified from aerial imagery). Electricity substation. No pollution incidents recorded in the vicinity.
	Extraction industries (mining, quarrying and mineral extraction): No quarries or mine entries identified from current or historical maps in study area. Coal seams are present at depth, but outside of CA mining reporting area. The superficial deposits at the site have the potential to be quarried at the site.
	Landfills and waste activities: No landfills or waste treatment facilities identified within the study area.
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of WWII bombing

Table 10-10: Stephen Bank to Carkin Moor baseline conditions summary

Feature category	Stephen Bank to Carkin Moor
Geology	**Superficial geology:** Glacial till (gravelly clays).
	Solid geology: Stainmore Formation comprising cyclical repetition of sandstones, siltstones, mudstones, thin limestones and some coals. Great Limestone Member Limestone comprising Carbonate material (coral, shell fragments). Alston Formation comprising Bioclastic limestones, sandstones, mudstones, siltstones and rare coals. Four Fathoms Limestone comprising Carbonate material (coral, shell fragments).
Geodiversity sites	No geological SSSI are identified. No geologically designated LNR are identified.
Hydrology and hydrogeology	**Surface watercourses:** Tributaries of Holme Beck (Medium value). **Groundwater:**

Feature category	Stephen Bank to Carkin Moor
	Bedrock: Secondary A aquifers (Medium value). Superficial deposits: Secondary (undifferentiated) aquifer (Medium value). A Zone 1 SPZ (Very high value) and two other groundwater abstractions for agricultural use (Medium value) are present within 500m of this scheme.
Soils	**Agricultural Land Classification:** With this scheme, Grade 3 agricultural land exists (High to Medium value). Mainly Grade 3a (High Value) with smaller areas of Grade 3b (Medium Value). Small areas of Urban soils present in the central and eastern areas. **NSRI soils data:** The soils are mapped as freely drained slightly acid loamy soils belonging to the Wick 1 and to the far east of the scheme the soils are mapped as Brickfield 2 Associations (groups of soil types typically found together in the landscape).
Potential contamination sources	**Current and historic land uses:** Agricultural land use and farms. Disused quarries and mine shaft. Tank. Operational naerobic digestion facility. Five pollution incidents are recorded in the vicinity.
	Extraction industries (mining, quarrying and mineral extraction): No mine entries identified from current or historical maps. Several disused sandstone and limestone quarries are, however, indicated within 250m of this scheme. Coal seams present at depth. The majority of the scheme is outside the CA mining reporting area, with the exception of a discrete area which appears to be associated with a shaft at a historical sandstone quarry that lies outside the current study area. The superficial deposits at the site have the potential to be quarried at the site.
	Landfills and waste activities: No landfills or waste treatment facilities have been identified within 250m of the alignment.
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of WWII bombing.

Table 10-11: A1(M) J53 Scotch Corner baseline conditions summary (not assessed at Option Selection stage)

Feature category	A1(M) J53 Scotch Corner
Geology	**Superficial geology:**

Feature category	A1(M) J53 Scotch Corner
	Glacial till (gravelly clays), locally thin or absent.
	Solid geology: Four Fathoms Limestone comprising Carbonate material (coral, shell fragments).
Geodiversity sites	No geological SSSI are identified. No geologically designated LNR are identified.
Hydrology and hydrogeology	**Surface watercourses:** None identified. **Groundwater:** Bedrock: Secondary A aquifer (Medium value). Superficial deposits: Secondary (undifferentiated) aquifer (Medium value). Not located within an SPZ. One abstraction is present in the vicinity, for agricultural use (Medium value).
Soils	**Agricultural Land Classification:** Grade 3 agricultural land (Medium to High Value). **NSRI soils data:** Slowly permeable seasonably wet acid loamy and clayey soils.
Potential contamination sources	**Current and historic land uses:** Agricultural land use and farms. Car salesroom. Electricity substation. Fuel station. No pollution incidents recorded in the vicinity.
	Extraction industries (mining, quarrying and mineral extraction): No current or historic quarries or mines indicated on available maps. The scheme is outside of CA coal mining reporting area. No coal outcrops or mine entries indicated within study area by CA interactive map viewer. Extensive shafts to the east of Middleton Tyas are understood to be associated with localised metalliferous mining. The superficial deposits at the site have the potential to be quarried at the site.
	Landfills and waste activities: No landfills or waste treatment facilities have been identified
	UXO: The site is indicated to be at low risk of unexploded bombs as a result of WWII bombing.

10.5 Potential impacts

Construction

10.5.1 During construction there will be a loss of agricultural soils, some of which will be High Value soils, falling within the 'best and most versatile' (BMV) classification (i.e. Grades 1, 2 and 3a). This loss will comprise both areas within the indicative DCO boundary, for example required for construction compounds and access. There will also be potential disruption to ongoing agricultural activities and potential fragmentation of land parcels (refer to *LA 112 Population and Human Health* (Highways England, 2020c)[134].

10.5.2 For areas of temporary development during construction (e.g. the formation of construction compound and storage areas, haul roads etc.) some BMV degradation will also occur. Evidence for the degree and extent of degradation will be quantified by comparison against the pre-construction baseline agricultural land classification (ALC) survey data, which will in turn inform post-construction soil restoration standards.

10.5.3 There is the potential for construction phase impacts on human health, surface water and groundwater quality associated with mobilisation of contaminants within the ground. Contamination could be present on or in the vicinity of the proposed development from current and past land uses or the composition of fill materials present on the site. This could include in areas of landfills and infilled ground, historical gypsum mining and other land-uses including farms, railways, filling stations and depots, tanks and other commercial or industrial land uses. Contamination could potentially be mobilised by exposure of materials, generation of dust, increased leaching following disturbance, surface run-off, or creation of migration pathways through, for example, groundwater control measures, piling or ground improvement works.

10.5.4 There is the potential that leaks or spills could occur from construction materials and equipment. It is envisaged that, with appropriate site controls, these are likely to be limited in extent.

10.5.5 No potential impacts on geodiversity resources have been identified based upon the existing baseline data.

Operation

10.5.6 Permanent loss of agricultural land, including BMV soils, will occur within the indicative DCO boundary. In addition, near surface agricultural soils adjacent to the road could be exposed to road spray and accidental spillages.

10.5.7 Unmitigated, there is the potential for contamination post-construction to locally have an impact on human health, surface water or groundwater quality. Through the implementation of appropriate controls and remediation works where necessary, the likelihood of any impact is reduced. Apotential exists that contamination risks could actually be reduced as a result of the project, resulting in a beneficial impact.

[134] Highways England (2020c) Population and human health, available at: https://www.standardsforhighways.co.uk/dmrb/search/1e13d6ac-755e-4d60-9735-f976bf64580a

10.6 Design, mitigation and enhancement measures

10.6.1 The design of the project is ongoing, along with the development of mitigation and enhancement measures relating to Geology and Soils. However, initial measures have been suggested below, which will be explored in more detail during the EIA process.

Design

10.6.2 Given the agricultural setting of the site, it will not be possible for impacts on agricultural soils to be entirely avoided through alignment or design of the proposed development. Impacts will be mitigated, where viable, through design by:

- minimising the project footprint; this is particularly relevant in areas of 'best and most versatile' land.
- where possible soils are to be retained within their field of origin
- micro-siting of proposed highways alignments and ancillary structures to minimise BMV land take where appropriate, potentially based on findings of detailed ALC survey data.

Mitigation

10.6.3 An intrusive agricultural soil survey is to be completed, to determine the ALC grade of land affected by the project. For areas of temporary development, ALC grade as determined from the soil survey will be used to inform the restoration criteria; BMV is to be returned to the same quality as far as reasonably practicable to minimise BMV losses and limit permanent impacts.

10.6.4 Soils are to be managed and protected during the construction works in accordance with good practice; this includes Defra's Code of practice for the sustainable use of soils on construction sites, guidance contained within HE's *Manual of Contract Documents for Highway Works* (Standards for Highways, 2020)[135] and relevant British Standards for use of soil on construction sites, which will be referenced in the EMP.

10.6.5 The proposed project shall have a restoration plan and statement which includes a restoration plan and statement, which it is anticipated may include the following:

- An assessment of agricultural land and soil resource of the site before work commences (as per Section 5 in the *Guide to assessing development proposals on agricultural land* (Natural England, 2021)[136] which is considered to represent UK good practice.
- The methods by which the applicant intends to restore appropriate affected areas to agricultural use after works including excavations and placement of fill materials has finished. The exact areas to be restored will be determined in due course but are expected to comprise the temporary land take areas, i.e. site compounds, construction working space and access routes required during the construction phase.

[135] Standards for Highways (2020) Manual of Contract Documents for Highway Works, available at: https://www.standardsforhighways.co.uk/ha/standards/mchw/index.htm
[136] Natural England (2021) Guide to assessing development proposals on agricultural land, available at: https://www.gov.uk/government/publications/agricultural-land-assess-proposals-for-development/guide-to-assessing-development-proposals-on-agricultural-land

- An aftercare programme which would enable a satisfactory standard of agricultural after-use to be reached, with regards to cultivating, reseeding, draining or irrigating, applying fertiliser, or cutting and grazing the site
- Maps to show the intended:
  - Landforms after restoration (showing contours on mapping at appropriate intervals)
  - Surface features, such as ditches, field boundaries and tracks
  - Habitat and water features

10.6.6 An intrusive ground investigation is currently being completed which was designed to provide adequate information for preliminary design and to inform the general understanding of baseline ground and contamination conditions in the environmental assessment.

10.6.7 The assessment of impacts on contaminated land will be primarily based on desk based sources, which will enable reasonable worst-case contamination conditions to be assessed based upon known past and current potentially contaminative land uses. The desk based information will be validated using the results of the intrusive ground investigation. Areas of contamination encountered during the investigation that are additional to those expected from desk based sources will be evaluated and, where appropriate, included within the assessment.

10.6.8 Further phases of detailed ground investigation will be undertaken at later stages of the project to inform detailed design, but the information will not be available in time for use in EIA. Data from any further phases of investigation will be used as a basis for undertaking contamination risk assessments on the potential risks to human health and water resources. Where the levels of contamination present unacceptable risks, the assessments will be used as a basis for developing an appropriate remediation strategy. Remediation approaches would be dependent on the form, distribution and levels of contaminants present and nature of works proposed in the area, and would be determined through a remediation options appraisal. Possible approaches may include provision of a suitable surface barrier, treatment (in-situ or ex-situ), appropriate re-use of materials in less sensitive areas in line with the Contaminated Land: Applications in Real Environments (CL:AIRE) *Definition of Waste Code of Practice* (Contaminated Land: Applications in Real Environments, 2011)[137], or removal of materials to an appropriate soil recycling or landfill facility.

10.6.9 The requirements for any remediation will be integrated with the engineering and geotechnical design to ensure the most appropriate and sustainable solutions are adopted. Where there is the potential that groundworks (such as foundations, ground improvement or mine stabilisation works) could create contamination migration pathways, risk assessments will be undertaken to inform selection of the appropriate form and method of construction. Construction quality and environmental controls will be established to ensure that potential impacts are appropriately controlled and mitigated.

10.6.10 Prior to any construction compound areas being prepared, a baseline survey will be undertaken to determine the current land quality in these areas to ensure that land quality is not impacted by the construction works. The baseline survey will highlight any contamination present. If necessary such areas would be remediated prior to, or as part of, the soil stripping/enabling works.

[137] Contaminated Land: Applications in Real Environments (2011) Definition of waste: Code of Practice, available at: https://www.claire.co.uk/projects-and-initiatives/dow-cop

10.6.11 The following are examples of additional mitigation measures that could be included in the EMP:

- Earthworks phases of the development could be monitored for evidence of potential contamination not anticipated based upon the available information. If any such contamination is identified, this would be tested and assessed as appropriate to determine the scope of any further mitigation measures that may be needed.
- Specific areas within the construction site compounds would be designated for the storage of chemicals, waste oils and fuel and refuelling activities. These areas would be bunded and placed on hardstanding to prevent downward migration of contaminants.
- An Emergency Response/Spill Response plan would be produced by the contractor. Clear protocols and communication channels will be provided to ensure that any spillages are dealt with immediately and adequately. It is envisaged that this could include protocols to deal with any buried animal carcases that may be encountered during construction.
- A Considerate Constructors Scheme could be in place to ensure disruption to on-going agricultural activities can be minimised.
- A Materials Management Plan (MMP) could be prepared following the protocols within the CL:AIRE *Definition of Waste Code of Practice* to ensure that excavated materials are re-used appropriately and sustainably.

10.6.12 Reference will also be made when preparing the EMP to the Environment Agency Pollution Prevention Guidelines and Construction Industry Research Information Association (CIRIA) publications.

10.6.13 The road surface will restrict the exposure of future site users such as members of the public and maintenance workers to any residual contamination remaining following any necessary remedial measures. Provision of appropriate, uncontaminated, topsoil in landscaped areas adjacent to the road will further restrict the risk of exposure. The road surface will also restrict infiltration which in turn will reduce the potential for contaminants (if present) leaching and migration into the wider water environment.

10.6.14 The operational impact on shallow soils and the water environment from road spray and spillages associated with the road usage will be mitigated using appropriate Sustainable Drainage Strategy (SuDS) to provide suitable treatment to control runoff quality (refer to Chapter 15: Road Drainage and Water Environment). Any soils which become significantly affected by pollution incidents during operation would need to be assessed and if necessary, remediated to reduce the risk of any contamination migrating across a wider area.

Enhancement

10.6.15 The EIA process will seek to identify beneficial opportunities for re-use of permanently displaced soil resource on-site within the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible).

10.6.16 Excavation works as part of the proposed scheme could potentially present opportunities for enhancement, through creation of temporary or permanent exposures in areas of geological importance. The potential for this will depend on the ground conditions, vertical alignment and proposed construction works. Where the nature of the scheme and site constraints allow, the opportunity for such enhancement could be explored with stakeholders.

10.7 Description of the Likely Significant Effects

10.7.1 The following presents a summary of the likely significant effects identified in the Option Selection stage *EAR*, following the implementation of mitigation.

Construction

10.7.2 There is likely to be a significant impact in relation to the loss agricultural soils in areas of 'best and most versatile' agricultural land.

10.7.3 Based upon the baseline information currently available, and given the design and mitigation measures proposed, no significant effects are anticipated during construction as a result of contamination on human health receptors or controlled waters. Significant effects on geological receptors are possible at Appleby to Brough (Warcop) and Bowes Bypass (A66/A67) due to the presence of the UNESCO Global Geopark designation in these schemes. Any significant effects will be confirmed by the assessment to be presented in the Preliminary Environmental Impact Report.

10.7.4 The indicative DCO boundary for some of the schemes is still being developed to reflect the potential alternative alignment routes still under consideration. For this reason, the study area has been conservatively defined in line with the largest geographical extents of alternatives and is therefore not fully refined yet. The potential for significant effects on human health receptors or controlled waters has therefore also not been fully determined at this time. The alternative alignment routes assessment will consider the potential for significant environmental effects, and this will be factored into decisions taken about the project. The ES will describe this process and report on any significant effects that are likely to result from the project as proposed.

10.7.5 To determine whether significant effects are likely as a result of contamination, an assessment process will be carried out for each scheme which will consider the potential for each identified contamination source to be disturbed or mobilised by the project, taking into account the location of the source relative to the indicative DCO boundary, the nature of the project in the vicinity of the source and the likely type and form of contaminants present. This assessment will be presented in the Preliminary Environmental Imact Report. If contamination sources cannot be screened out following this initial assessment, then further, more detailed assessment will be carried out and reported in the ES.

10.7.6 With regard to the potential for foot and mouth burials, this will be mitigated as part of the EMP, as discussed in Section 10.6.6. Further information on contamination hazards at Longriggs mine will be required to appropriately characterise the above and rule out potential associated signficant impacts. It is therefore considered premature to scope out contamination impacts at the current stage in their entirety. Table 10-12 presents a summary of the schemes where particular aspects may be either scoped in or out based upon the current information. Where further information or assessment is considered necessary to rule out significant impacts, aspects have remained scoped in at present.

Operation

10.7.7 Based upon the available baseline information, given the design and mitigation measures proposed, no significant effects are anticipated during operation on geological receptors or as a result of contamination on human health receptors or controlled waters. Any historical contamination present within the scheme boundary

will be identified and remediated during construction and would not be expected to pose a risk during operation.

10.8 Assessment Methodology

10.8.1 The methodology will follow the requirements of *DMRB LA 109*. The scope of the assessment to be undertaken and reported in the ES will comprise:

- Impact on geology and superficial deposits, in particular associated with designated sites
- Impacts on soil resources, in particular agricultural soils
- Impacts on human health, surface water and groundwater arising from the project's interaction with contamination. Note that the assessment of risks to workers is not a requirement for the EIA. In the UK such risks are controlled by legislation such as the *Construction (Design and Management) Regulations 2015 (as amended)* (Legislation, 2015)[138].

10.8.2 The data reviewed at baseline (presented in

10.8.3 Table 10-3 to Table 10-11 above) has not identified significant potential for UXO for this project, therefore we are seeking to scope out UXO assessment for the Geology & Soils topic. The assessment of UXO risks to workers is not a requirement for the EIA, as discussed above, and such risks would be managed as a construction risk.

10.8.4 The above scope includes the potentially significant impacts identified on agricultural soils.

10.8.5 As stated in Section 10.6, the assessment of impacts on contaminated land will be primarily based on desk based sources, which will enable reasonable worst-case contamination conditions to be assessed. As part of the EIA, the previously identified baseline conditions have been reviewed and updated for the project. The results of the intrusive ground investigation completed in Spring 2021, and agricultural soil survey data, will be incorporated once available. At the present time, it is anticipated that sufficient ground investigation data will be available to establish preliminary conceptual site models and identify likely significant effects within the ES. Detailed risk assessments and remediation strategy design will be undertaken at detailed design stage prior to construction.

10.8.6 For M6 J40 Penrith and A1(M) J53 Scotch Corner, which were not assessed at the earlier Option Selection stage, the baseline conditions have been established through a review of the available Option Selection stage data, supplemented by additional desk-based baseline data obtained subsequently.

10.8.7 The assessment of impact on geology and superficial deposits will consider geological designations and sensitive or valuable non-designated features. This will include the locations of sites such as SSSI, Areas of Special Scientific Interest (ASSI), Local Geological or Geodiversity Sites (LGS) (formerly Regional Important Geological or Geodiversity Sites), Geological Conservation Review (GCR) sites and Earth Science Conservation Review sites. The locations of such sites have been established through public data sets, supplemented by engagement with Local Authorities and the BGS.

10.8.8 The potential impacts of the project on agricultural soils will consider the ALC of the land that may be affected by a project. Baseline conditions have been established

[138] Legislation (2015) Health and Safety. The Construction (Design and Management) Regulations 2015 (as amended), available at: https://www.legislation.gov.uk/uksi/2015/51/pdfs/uksi_20150051_en.pdf

from ALC regional maps. This will be supplemented by a soil resource survey in areas of the proposed development where data is incomplete or unavailable. This includes in areas of Grade 3 land, where it will be necessary to establish whether or not it comprises 'best and most versatile' land. The assessment of ALC grade will be carried out in line with the Ministry of Agriculture Fisheries and Food (MAFF) ALC Guidelines – the revised guidelines and criteria for grading the quality of agricultural land (Ministry of Agriculture, Fisheries and Food,1988)[139] and other relevant guidance. The scope of works, findings and proposed mitigation measures will be subject to consultation with Natural England.

10.8.9 The potential for soil and groundwater contamination within the study area will be established through a review of the available historical maps, information on landfills and mineral extraction activities supplemented with additional desk based information from public data sets and engagement with Local Authorities, the Environment Agency, British Gypsum, MoD, the Animal and Plant Health Agency and National Farmers' Union. Additional information will be sought on the following potential risk areas:

- Groundwater/mine water conditions and quality around Longriggs mine
- Potential ordnance hazards at Warcop training facility
- Potential animal burial pits associated with foot and mouth where Local Authority records are available
- Additional information on historic and current landfill sites such as Hulands Quarry that can be provided by the EA or Local Authorities.

10.8.10 The findings of the desk based study will be supplemented by the results of the intrusive ground investigation completed in Spring 2021. This will provide a better understanding of ground conditions and typical contamination conditions across the site and will be reported in the ES.

10.8.11 With respect to existing land contamination, a source, pathway receptor approach will be applied to examine how the project would influence baseline conditions. The general approach outlined within the EA *Land Contamination: Risk Management* (LCRM) (Environment Agency, 2020)[140] guidance will be adopted for assessing risks, updated to to reflect guidance available at the commencement of the assessment provided by EA LCRM. Potential contaminants will be identified using the Department of Environment (DoE) *Industry Profiles* series of documents (Department of Environment, 1995)[141]. Conceptual models will be developed for each of the baseline, construction and operation scenarios, with the risks arising from the identified pollutant linkages assessed qualitatively in line with the guidance provided in CIRIA C522: *Contaminated land risk assessment: a guide to good practice* (2001). These risks will be compared to identify any impacts arising from the construction or operation of the proposed scheme, the significance of which will then be assessed in accordance with the criteria provided by *DMRB LA 109*.

10.8.12 The key potential receptors of contamination that will be assessed are human health, groundwater and surface water resources. The locations and vulnerability of these receptors will be established through current mapping, public data sets and baseline

[139] Ministry of Agriculture, Fisheries and Food (1988) Agricultural Land classification of England and Wales, available at: http://publications.naturalengland.org.uk/publication/6257050620264448
[140] Environment Agency (2020) Land contamination risk management, available at: https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm
[141] Department of Environment (1995) DoE Industry Profiles, available at: https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/198-doe-industry-profiles

data acquired for *DMRB LA 113*. The contamination assessment will not specifically assess potential impacts of contamination on ecological receptors, however, the findings will be co-ordinated with the assessment presented in *DMRB LA 108 Biodiversity* (Highways England, 2020c)[142] to ensure that any potential impacts can be appropriately addressed.

Assessment of Significance

10.8.13 The approach to assessment of significance has been revised since the Option Selection stage in light of updated DMRB standards.

10.8.14 The value (sensitivity) of the identified receptors will be determined against the criteria provided in Table 3.11 of *DMRB LA 109*. This references the criteria set out in *DMRB LA 113*, Table 3.70, for surface water and groundwater.

10.8.15 The magnitude of impact will be determined using the criteria provided in Table 3.12 of *DMRB LA 109*, as amended by Table E/2.1 of the England National Application Annex. Table 3.12 also references the criteria set out in *DMRB LA 113* , Table 3.71. In the absence of any specific criteria in *DMRB LA 109* or defining beneficial impacts in relation to Geology and Soils, the general descriptions provided in *DMRB LA 104*, Table 3.4N will be applied where necessary. In line with *DMRB LA 104*, the significance of an impact is a factor of:

- The value of the feature / resource (receptor)
- The magnitude of the impacts (change) that occur

10.8.16 Table 5-1 in Chapter 5: Environmental Assessment Methodology shows how the significance of effects will be derived from the value and magnitude. A significant effect is defined in *DMRB LA 109* as *"effects that remain within the moderate, large or very large categories once mitigation has been taken into account".*

10.9 Assessment Assumptions and Limitations

10.9.1 The information contained within this geology and soils scoping chapter is based upon assessment work undertaken at earlier stages of the project together with reviews of supplementary information obtained subsequently. Where areas were not previously assessed at Option Selection stage, a review of readily available data has been used to inform the baseline and likely impacts. These will be refined as part of the assessment.

10.9.2 The extent of the study area used for scoping the geology and soils assessment has not been fully refined for some of the schemes due to the absence of a final DCO boundary that includes any confirmed construction compound or temporary works locations. The information presented in this scoping report attempts to provide suitable coverage to enable the potential risks associated with such areas to be appropriately considered.

10.9.3 The geology and soils assessment is to be undertaken on the basis of desk study data supplemented by data from the intrusive ground investigation completed in Spring 2021, and agricultural soil survey data. This will enable reasonable worst-case conditions to be assessed. Further phases of detailed ground investigation will be undertaken at later stages of the project to inform detailed design but this information will not be available in time to inform EIA.

[142] Highways England (2020d) Biodiversity LA 108, available at: https://www.standardsforhighways.co.uk/dmrb/search/af0517ba-14d2-4a52-aa6d-1b21ba05b465

10.9.4 The assessment will be predominantly qualitative in nature, but will take into account the findings of generic quantitative contamination risk assessments undertaken on the available ground investigation information.

Table 10-12: Geology scoping criteria from *DMRB LA 109* - construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) is the project likely to affect designated geological sites (statutory or non-statutory)?	N	N	N	N	Y	Y	N	N	N	N
2) is the project likely to affect the function or quality of soil as a resource?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3) is the project likely to affect agricultural land classified as good and most versatile or prime land?	Y[143]	Y[107]	Y[107]	Y[107]	Y[107]	Y[107]	Y[107]	Y[107]	N	Y[107]
4) is the project likely to disturb historical contamination?	Y	Y	Y	TBC	TBC	Y	TBC	Y	TBC	N
5) is the project likely to introduce significant sources of contamination?	N	N	N	N	N	N	N	N	N	N
Key Mitigation	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation. Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation. Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation. Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures ensuring soils are managed and	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation. Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation. Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation. Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation. Agricultural soils: Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures ensuring soils are managed and protected during	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation. Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures ensuring soils are managed and	Contamination: Intrusive investigation and, if unacceptable risks are identified, remediation.	Agricultural soils: minimise project footprint; micro-siting of proposed highways and structures ensuring soils are managed and protected during the construction works in accordance with good practice; Identifying beneficial opportunities for re-

[143] Study area includes Grade 3 agricultural land. Detailed assessment required to confirm extent of BMV.

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
	ensuring soils are managed and protected during the construction works in accordance with good practice; Identifying beneficial opportunities for re-use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible).	ensuring soils are managed and protected during the construction works in accordance with good practice; Identifying beneficial opportunities for re-use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible).	protected during the construction works in accordance with good practice; Identifying beneficial opportunities for re-use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible).	ensuring soils are managed and protected during the construction works in accordance with good practice; Identifying beneficial opportunities for re-use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible).	ensuring soils are managed and protected during the construction works in accordance with good practice; Identifying beneficial opportunities for re-use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible). Geological features: Excavation works may provide opportunity for mitigation of loss of geological exposures.	ensuring soils are managed and protected during the construction works in accordance with good practice; Identifying beneficial opportunities for re-use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible). Geological features: Excavation works may provide opportunity for mitigation of loss of geological exposures.	the construction works in accordance with good practice; Identifying beneficial opportunities for re-use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible).	protected during the construction works in accordance with good practice; Identifying beneficial opportunities for re-use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible).		use of permanently displaced soil on-site in the indicative DCO boundary, or off-site re-use (should re-use on-site not be feasible).
Proposed Scope (In)	Soil resources Historic contamination	Soil resources Historic contamination	Soil resources Historic contamination	Soil resources Historic contamination	Geological features Soil resources Historic contamination	Geological features Soil resources Historic contamination	Soil resources Historic contamination	Soil resources Historic contamination	Historic contamination	Soil resources
Proposed Scope (Out)	Geological features Historic contamination New contamination UXO	Geological features Historic contamination New contamination UXO	Geological features Historic contamination New contamination UXO	Geological features Historic contamination New contamination UXO	New contamination UXO	New contamination UXO	Geological features Historic contamination New contamination UXO	Geological features Historic contamination New contamination UXO	Geological features Historic contamination New contamination UXO	Geological features Historic contamination New contamination UXO

Table 10-13: Geology scoping criteria from *DMRB LA 109* - Operation

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) is the project likely to affect designated geological sites (statutory or non-statutory)?	N	N	N	N	N	N	N	N	N	N
2) is the project likely to affect the function or quality of soil as a resource?	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
3) is the project likely to affect agricultural land classified as good and most versatile (BMV) or prime land?	Y[144]	Y[108]	Y[108]	Y[108]	Y[108]	Y[108]	Y[108]	Y[108]	N	Y[108]
4) is the project likely to disturb historical contamination?	N[145]	N[109]	N[109]	N[109]	N[109]	N[109]	N[109]	N[109]	N[109]	N
5) is the project likely to introduce significant sources of contamination?	N	N	N	N	N	N	N	N	N	N
Key Mitigation	Agricultural soils: Minimisation of footprint. Restoration of affected areas.	Agricultural soils: Minimisation of footprint. Restoration of affected areas. Geological features: Potential to provide new geological exposures.	Agricultural soils: Minimisation of footprint. Restoration of affected areas. Geological features: Potential to provide new geological exposures.	Agricultural soils: Minimisation of footprint. Restoration of affected areas. Geological features: Potential to provide new geological exposures.	Agricultural soils: Minimisation of footprint. Restoration of affected areas. Geological features: Potential to provide new geological exposures.	Agricultural soils: Minimisation of footprint. Restoration of affected areas. Geological features: Potential to provide new geological exposures.	Agricultural soils: Minimisation of footprint. Restoration of affected areas. Geological features: Potential to provide new geological exposures.	Agricultural soils: Minimisation of footprint. Restoration of affected areas. Geological features: Potential to provide new geological exposures.	None	Agricultural soils: Minimisation of footprint. Restoration of affected areas.
Proposed Scope (In)	Soil resources	Soil resources	Soil resources	Soil resources	Soil resources	Soil resources	Soil resources	Soil resources	N/A	Soil resources

[144] Study area includes grade 3 agricultural land. Detailed assessment required to confirm extent of BMV.
[145] Any historical sources of contamination present within the proposed scheme will be identified and remediated during construction. Risks should not remain in operation, see Section 10.7.7.

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Proposed Scope (Out)	Geological features Historic contamination New contamination	Geological features Historic contamination New contamination	Geological features Historic contamination New contamination	Geological features Historic contamination New contamination	Geological features Historic contamination New contamination	Geological features Historic contamination New contamination	Geological features Historic contamination New contamination	Geological features Historic contamination New contamination	Soil resources Geological features Historic contamination New contamination	Geological features Historic contamination New contamination

11 Landscape and Visual

11.1 Introduction

11.1.1 This chapter outlines the proposed scope of assessment to be undertaken for landscape and visual effects.

11.1.2 There may be interrelationships related to the potential effects on the landscape with other disciplines. Therefore, please also refer to the following chapters:

- Chapter 7: Biodiversity
- Chapter 9: Cultural Heritage
- Chapter 13: Noise and Vibration

11.1.3 The methodology used will follow the requirements of *DMRB LA 107 Landscape and Visual Effects* (Highways England, 2020a)[146], *DMRB LA 104 Environmental assessment and monitoring* (Highways, England, 2020b)[147], and *Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA3)* (Landscape Institute and Institute of Environmental Management and Assessment, 2013)[148].

11.2 Key Questions for scoping

1. Do you agree with the proposed scope of the landscape and visual assessment outlined in this chapter?
2. Do you agree with the proposed study area and proposed methodology for undertaking the landscape and visual assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any baseline information or data that you wish to draw our attention to, or can provide us with to inform our assessments?
4. Are there any other key issues or aspects relevant to the landscape and visual assessment that you wish to bring to the attention of the design and assessment team?
5. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

11.3 Study area

11.3.1 *DMRB LA 107* requires the study area to be identified on a project-by-project basis using four criteria for landscape effects and four criteria for visual effects. These criteria are listed below in Table 11-1 with rationale to justify the proposed extent of the study area.

11.3.2 An initial Zone of Theorectical Visibility (ZTV) was produced extending 10km from the project as a first step in establishing the extent of the initial study area. During preliminary fieldwork the wider landscape context of the project was also considered, and visibility within and intervisibility between landscape receptors was a factor in

[146] Highways England (2020a) Landscape and visual effects, Revision 2 LA 107, available at: https://www.standardsforhighways.co.uk/dmrb/search/bc8a371f-2443-4761-af5d-f37d632c5734
[147] Highways England (2020b) Environmental assessment, and monitoring, Revision 1 LA 104, available at: https://www.standardsforhighways.co.uk/prod/attachments/0f6e0b6a-d08e-4673-8691-cab564d4a60a?inline=true
[148] Landscape Institute and Institute for Environmental Management and Assessment, 3rd Edition 2013

refining the proposed study area. This led to establishment of the proposed 7km study area.

11.3.3 However, due to some of the schemes (Temple Sowerby to Appleby, Appleby to Brough (Warcop) and Bowes Bypass (A66/A67)) being located close to the North Pennines Area of Outstanding Natural Beauty (AONB), it is proposed that the visual study area for these schemes is extended at this stage to 7km in order to selectively capture visibility from visual receptors that may be affected. Visibility from selectively chosen visual receptors will be assessed within the wider visual study area for these schemes.

11.3.4 Similarily with landscape effects, significant effects are likely to be limited to the Landscape Character Areas (LCA) directly affected by the project. However, at this stage all LCA that fall within the study area will be considered in the assessment, including those that are only marginally located within it. Visibility of the project from the study area for Temple Sowerby to Appleby, Appleby to Brough (Warcop) and Bowes Bypass (A66/A67) will inform the assessment of effects on the North Pennines AONB.

11.3.5 The extent of the study area is not intended to be a fixed or absolute limit. Where additional information is considered to be required to provide sufficient context to the assessment of landscape and visual effects, both relevant baseline information and the assessment will be included.

11.3.6 As a result of consultation and engagement at the Technical Working Group an approximate area of the AONB has also been identified for the assessment of effects on this designation. This area covers approximately 7km in the eastern part and up to 5km in the western part of the AONB.

Table 11-1: DMRB study area selection criteria

Criteria	Rationale
Landscape effects	
The study area shall be identified on a project by project basis and be proportionate to the following factors: 1) the project boundary/construction activity (including compounds and temporary land take); 2) the wider landscape setting within which the project/its works has the potential to influence. 3) the extent of the area visible by the project; and 4) the full extent of adjacent or affected landscape receptors of special value (i.e. conservation areas, designated areas) whose setting can be influenced by the project.	The proposed 7km study area study area for landscape effects has been informed by: 1) Indicative DCO boundary (see Figure 2-1). 2) The wider setting of the project has been considered including visibility of the project and other factors such as topography (see Figure 11-1 in Chapter 18: Figures) and perceptual and aesthetic factors, including tranquillity. 3) The Zone of Theoretical Visibility (ZTV), initially produced to 10km from the indicative DCO boundary was subsequently verified by field surveys and refined to 7km. This will remain under review through the assessment. 4) The full extent of adjacent landscape designations has also been considered and this has been informed by engagement with stakeholders.

Criteria	Rationale
Visual effects	
The study area shall be identified on a project by project basis and proportionate to the following factors: 1) the project/construction visual footprint (including compounds and temporary land take); 2) the wider visual envelope within which the project has the potential to influence. 3) the extent of representative viewpoints visible of the project; and 4) the extent of adjacent or affected visual receptors and the visual amenity of the area that can be influenced by the project.	The proposed 7km study area for visual effects has been informed by: 1) Consideration of the visual footprint of the project and construction. 2) The wider visual envelope. A range of long-distance views within the study area has been selected, but also beyond the 7km study area if considered appropriate, informed by engagement with stakeholders. 3) The extent of representative viewpoints. A broad range of viewpoints, representing a variety of receptor categories, have been selected. 4) The extent of affected visual receptors and visual amenity, which has resulted in selection of a large number of viewpoints.

11.4 Overview of consultation to date

11.4.1 Table 11-2 identifies the key comments received to date from external consultees on the scope and approach to the landscape and visual assessment.

Table 11-2: Landscape and visual assessment scope comments to date

Respondent	Comment	How addressed /to be addressed
Natural England, email dated 29 March 2021	Potential viewpoint locations proposed including views from elevated parts of the AONB area such as Knock Pike, Dufton Pike, and the Pennine Way National Trail and Hilton. Query raised if potential viewpoints were selected to reflect potential changes to the route alignment.	Viewpoints from elevated parts of the AONB added following separate consultation with the North Pennines AONB Partnership. These include viewpoints from Dufton Pike and Pennine Way National Trail, and Hilton. Viewpoint locations were selected to account for potential changes to the route alignment (see Figures 11-5 and 11-6).
North Pennines AONB Partnership, emails dated 29 and 30 March 2020	Potential viewpoint locations proposed from: Scordale bridleway, Dufton Pike, Knock Pike, the Great Dun/Little Dun/Cross Fells range, view from High Cup Nick on the Pennine Way National Trail and NATS road to Great Dun Fell.	Viewpoint locations were included from Dufton Pike, High Cup Nick, the Pennine Way, and National Trail (see Figures 11-5 and 11-6).

Respondent	Comment	How addressed /to be addressed
Durham County Council email dated 31 March 2021	Agreed with the viewpoint selection.	No action required.
Response to informal scoping report from Statutory Environmental Bodies (SEBs) and other stakeholders	A range of comments were issued to inform the formal Scoping Report:	
	• Explore potential for inclusion of new woodland and wetland habitats as part of mitigation and enhancement;	Noted.
	• Liaise regarding key qualities of the North Pennie AONB, with the AONB Partnership;	Liaison regarding viewpoints and key qualities of the AONB is undertaken through the viewpoint consultation and continues to be informed through Technical Working Group TWG (see above).
	• Include assessment of the views from residential properties within the EIA or provide a separate RVA assessment;	A broad range of visual receptors from residential properties has been identified.
	• Mitigation to take into account residential receptors;	The mitigation of effects on affected residential properties will also be considered (noted for design).
	• The need for Arboricultural Impact Assessment has been highlighted,	A tree survey/arboricultural assessment will inform the EIA.
	• The importance of accurate records of ancient woodland and veteran trees has been highlighted.	The records of ancient woodland and veteran trees are available (Chapter 7: Biodiversity)

11.5 Baseline conditions

Landscape

11.5.1 Landscape effects arise from direct physical changes to the fabric or individual elements of the landscape. They also relate to the potential indirect changes to the wider patterns of land use, land cover, and the arrangement of landscape features

which determine the character and the aesthetic and perceptual qualities of the landscape.

Landscape character

11.5.2 The landscape resource within the study area is described in the published Landscape Character Assessment at National and County level.

National Landscape Character Assessments

11.5.3 Natural England has produced individual National Character Area (NCA) profiles for England to characterise landscape character at a large scale, national level. Each NCA profile is defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity.

11.5.4 The NCA profiles relevant to the project are listed in Table 11-3 below.

Table 11-3: NCA profiles relevant to the project

Projects	Relevant NCA profiles
M6 Junction 40	*NCA 09: Eden Valley* (Natural England, 2013a)[149]
M6 Junction 40 to Kemplay Bank Roundabout	*NCA 09: Eden Valley*
Penrith to Temple Sowerby (Center Parcs)	*NCA 09: Eden Valley* *NCA 17: Orton Fells (Natural England, 2013b)*[150]
Temple Sowerby to Appleby	*NCA 09: Eden Valley* *NCA 10: North Pennines* (Natural England, 2013c)[151] *NCA 17: Orton Fells*
Appleby to Brough (Warcop)	*NCA 09: Eden Valley* *NCA 10: North Pennines* *NCA 17: Orton Fells*
Bowes Bypass (A66/A67)	*NCA 10: North Pennines* *NCA 21: Yorkshire Dales* (Natural England, 2013d)[152] *NCA 22: Pennine Dales Fringe* (Natural England, 2013e)[153]
Cross Lanes to Rokeby	*NCA 22: Pennine Dales Fringe*
Stephen Bank to Carkin Moor	*NCA 22: Pennine Dales Fringe*

[149] Natural England (2013a) NCA Profile: 09 Eden Valley (NE502), available at: http://publications.naturalengland.org.uk/publication/5866662964232192
[150]Natural England (2013b) NCA Profile: 17 Orton Fells (NE487), available at: http://publications.naturalengland.org.uk/publication/5512822184214528
[151] Natural England (2013c) NCA Profile: 10 North Pennines (NE428), available at: http://publications.naturalengland.org.uk/publication/5682293
[152] Natural England (2013d) NCA Profile: 21 Yorkshire Dales (NE399), available at: http://publications.naturalengland.org.uk/publication/4674002
[153] Natural England (2013e) NCA Profile: 22 Pennine Dales Fringe (NE474), available at: http://publications.naturalengland.org.uk/publication/5619375490990080

Projects	Relevant NCA profiles
	NCA 23: Tees Lowlands[154] *NCA 24: Vale of Mowbray*[155]
A1(M) Junction 53 Scotch Corner	*NCA 22: Pennine Dales Fringe* *NCA 23: Tees Lowlands* *NCA 24: Vale of Mowbray*

Regional Landscape Character Assessments

11.5.5 The study area crosses areas characterised in three published Landscape Character Assessments, which will be reviewed as part of the assessment:

- The *Cumbria Landscape Character Guidance and Toolkit*: Part One - Landscape Character Guidance (Cumbria County Council, 2011)[156]
- *County Durham Landscape Character Assessment* (Durham County Council, 2008)[157]
- *North Yorkshire and York Landscape Characterisation Project* (North Yorkshire County Council, 2011)[158]

11.5.6 Published baseline data will be augmented by field surveys and a review of other documents that will inform the landscape character assessments:

- *North Pennines AONB Management Plan* (North Pennines AONB Partnership, 2018)[159]
- *North Pennines AONB Planning Guidelines* (North Pennines AONB Partnership, 2011)[160]
- *North Pennines AONB Moorland Tracks and Access Roads Planning Guidance Note* (North Pennines AONB Partnership, 2017)[161]

11.5.7 To aid clarity, for the purpose of this assessment landscape character units of similar scale were selected from published landscape character assessments and are referred to as Landscape Character Areas herafter .

[154] Natural England (2013f) NCA Profile: 23 Tees Lowlands (NE439), available at: http://publications.naturalengland.org.uk/publication/9860030
[155] Natural England (2013g) NCA Profile: 24 Vale of Mowbray (NE442), available at: http://publications.naturalengland.org.uk/publication/9856012#:~:text=This%20record%20was%20published%20by,Swale%2C%20Wiske%20and%20Cod%20Beck.
[156] Cumbria County Council (2011a) Cumbria Landscape Character Guidance and Toolkit, available at: https://www.cumbria.gov.uk/eLibrary/Content/Internet/538/755/2789/406869467.pdf
[157] Durham County Council (2008) County Durham LCA, available at: http://www.durhamlandscape.info/article/10054/The-Landscape-Character-Assessment
[158] North Yorkshire County Council (2011) North Yorkshire and York Landscape Characterisation Project, available at: https://www.northyorks.gov.uk/sites/default/files/fileroot/Environment%20and%20waste/Conservation/North_Yorkshire_and_York_landscape_character_assessment_report.pdf
[159] North Pennines AONB Partnership (2018) Management Plan, available at: https://www.northpennines.org.uk/wp-content/uploads/2019/06/MPlan-220719-webres.pdf
[160] North Pennines AONB Partnership (2011) North Pennines AONB Planning Guidelines available at: https://www.northpennines.org.uk/wp-content/uploads/2019/11/North-Pennines-AONB-Planning-Guidelines.pdf
[161] North Pennines AONB Partnership (2017) North Pennines AONB Moorland Tracks and Access Roads Planning Guidance Note available at: https://www.northpennines.org.uk/wp-content/uploads/2019/11/North-Pennines-AONB-Partnership-Tracks-Guidance-Published-Jan-2018.pdf

11.5.8 Table 11-4 identifies the relevant Landscape Character Areas coinciding wholly or partly with the 2km buffer that are a reflection of landscape character with associated descriptions of their character and identification of their key characteristics.

Table 11-4: Landscape Character Types/Areas relevant to the project

Scheme	Landscape Character Areas
M6 Junction 40	
Urban Area (00)	Intermediate Farmland (6)
Sandstone Ridge (10)	Rolling Fringe (12b)
Limestone Foothills (12c)	
M6 Junction 40 to Kemplay Bank Roundabout	
Urban Area (00)	Rolling Fringe (12b)
Intermediate Farmland (06)	Sandstone Ridge (10)
Broad Valleys (08b)	
Penrith to Temple Sowerby (Center Parcs)	
Intermediate Farmland (06)	Urban (00)
Broad Valleys (08b)	Rolling Fringe (12b)
Sandstone Ridge (10)	Foothills (11a)
Temple Sowerby to Appleby	
Broad Valleys (08b)	Foothills (11a)
Intermediate Farmland (06)	Sandstone Ridge (10)
Intermediate Moorland Plateau (09)	Moorland, High Plateau (13b)
Appleby to Brough (Warcop)	
Foothills (11a)	Scarps (13a)
Broad Valleys (08b)	Intermediate Moorland Plateau (09)
Moorland, High Plateau (13b)	
Bowes Bypass (A66/A67)	
Bowes	Boldron and Lartington
Cotherstone Moor	Barningham, Hope and Scargill Moors
Lower Greta	Mid Greta Valley
Sleightholme and Greta Fringes	Stainmore
Deepdale Moorland Fringe	
Cross Lane to Rokeby	
Barningham, Brignall and Rokeby	Boldron and Lartington
Newsham and Cleatlam	Moorhouse and Gillbeck
Lower Greta	River Tees
Southern Tees Vale: Hutton Magna	

Scheme	Landscape Character Areas
Stephen Bank to Carkin Moor	
Moors Fringe	Southern Tees Vale: Hutton Magna
A1(M) Junction 53 Scotch Corner	
Moors Fringe	Vale Farmland

Landscape and other Designations relevant to the project

11.5.9 The landscape, townscape, and other environmental designations within the study area relevant to the landscape and visual assessment are summarised below.

Areas of Outstanding Natural Beauty

11.5.10 North Pennines AONB is located to the north of the existing A66 along the Appleby to Brough (Warcop) scheme and at the western end of the Bowes Bypass (A66/A67) scheme. The AONB is located to the north, west, and south of the project in these locations. The effects of the project on the AONB will be fully assessed. The character descriptions included in the North Pennines AONB Management Plan (2019-2024) will also inform the assessment.

National Parks

11.5.11 A small area of the Lake District National Park coincides with the eastern part of the study area and the boundary of the National Park is approximately 500m from the edge of the 2km buffer associated with the M6 Junction 40 scheme. The setting of the National Park within this area is heavily influenced by major highways and other transport infrastructure such as the M6 and West Coast Mainline railway and as such, the limited works in this area are not considered likely to have a noticeable impact on the setting of the Lake District National Park. Effects on this designation are therefore proposed to be scoped out of the EIA.

11.5.12 Yorkshire Dales National Park is located to the south of the Appleby to Brough (Warcop) and Bowes Bypass (A66/A67) schemes and a small area coincides with the study area. The distance from the project varies along the route but is approximately 3km from the centerline of Appleby to Brough (Warcop) and approximately 4.5km from Bowes Bypass (A66/A67). Effects on the Yorkshire Dales National Park are proposed to be scoped into the EIA.

Area of High Landscape Value – Durham County Council

11.5.13 Area of High Landscape Value were identified as having particularly valued attributes which would benefit from additional protection. Appleby to Brough (Warcop) and Bowes Bypass (A66/A67) schemes cross the AHLV and the effects on this designation will be assessed in the EIA.

Registered Park and Gardens

11.5.14 Rokeby Registered Park and Garden will be affected by Cross Lane to Rokeby Scheme. The Rokeby Park gardens are protected through designation as a Grade II* Registered Park and Garden, with key focus of protection being on the garden grounds. The historic parks represent a scenic value and are a living record of evolving English landscape design.

Conservation Areas

11.5.15 The following conservation areas have been identified within the 2km buffer area and the rationale for their scoping out or scoping in has been included in Table 11-5 below

Table 11-5: Conservation Areas relevant to the project

Conservation Areas and Scheme	Scoped in/out rationale
Penrith Conservation Area	
M6 Junction 40	Scoped out. This conservation area is located approximately 900m to the northeast of this scheme. There are no views available from this designation as they are screened by surrounding built form. It is not anticipated that the project will affect key qualities of this conservation area.
M6 Junction 40 to Kemplay Bank Roundabout	Scoped out. This conservation area is located approximately 800m to the north of this scheme. The views from this area are fully screened by the surrounding built form and it is not anticipated that the project will affect key qualities of this conservation area.
Penrith New Streets Conservation Area	
M6 Junction 40	Scoped out. This conservation area is located approximately 1.4km to the north-east of this scheme. The built form screens the views from the conservation area and it is not anticipated that the project will affect key qualities of this conservation area.
M6 Junction 40 to Kemplay Bank Roundabout	Scoped out. This conservation area is located approximately 1.5km to the north-east of this scheme. The built form screens the views from the conservation area and it is not anticipated that the project will affect key qualities of this conservation area.
Temple Sowerby Conservation Area	
Temple Sowerby to Appleby	Scoped out. This conservation area is located approximately 500m to the west of this scheme. As the views are screened by the built form of residential properties at Croft Place, Vicarage Lane, and Eden Place, the project will not affect key qualities of this conservation area.
Appleby-In-Westmorland Conservation Area	
Appleby to Brough (Warcop)	Scoped out. This conservation area lies in the heart of the Eden Valley and is located approximately 1km south-east of this scheme. The views out from this conservation area to the west towards the project are completely screened by a woodland belt along the River Eden and a tree belt between the river and Appleby Grammar School. It is therefore not expected that the project will affect the key qualities of this conservation area.
Settle to Carlisle Railway Conservation Area	
Penrith to Temple Sowerby	Scoped out. This conservation area passes through the Eden Valley and falls partially within the northern extent of the study area of these schemes. This conservation area crosses the A66 at Temple Sowerby to Appleby, however a long section of the rail route is located in the

Conservation Areas and Scheme	Scoped in/out rationale
(Center Parcs) Temple Sowerby to Appleby	cutting or screened by tree belts where on embankment. In addition, screening is provided by raised landform along the Roman road at the western end of the Temple Sowerby to Appleby scheme. It is therefore not expected that the project will affect the key qualities of this conservation area.
Church Brough Conservation Area	
Appleby to Brough (Warcop)	Scoped out. This conservation area lies along the A66 and is located approximately 1km south-east of Appleby to Brough (Warcop). Trees along Swindale Beck screen the views from this conservation area. It is therefore not expected that the project will affect the key qualities of this conservation area.
Bowes Conservation Area	
Bowes Bypass (A66/A67)	Scoped In. This conservation area lies directly to the south of the Bowes Bypass (A66/A67) scheme and the effects on this conservation area will be further assessed in the EIA.
Greta Bridge Conservation Area	
Cross Lanes to Rokeby	Scoped in. This conservation area lies directly on the A66 approximately 250m south-east of this scheme and the effects on this conservation area will be further assessed in the EIA.
Barnard Castle Conservation Area	
Cross Lanes to Rokeby	Scoped out. This conservation area falls within the northern extents of the study area for this scheme. Views are screened by a tree belt along the eastern boundary of this conservation area and Sally Gill Plantation to the east of Barnard Castle. It is therefore not expected that the project will affect the key qualities of this conservation area.
Middleton Tyas Conservation Area	
A1(M) Junction 53 Scotch Corner	Scoped out. This conservation area lies approximately 700m east of this scheme covering the historic core of the village of Middleton Tyas. Views are screened by residential properties to the west of the conservation area. It is therefore not expected that the project will affect the key qualities of this conservation area.

Country Parks

11.5.16 Wetheriggs Country Park is located on the southern edge of Penrith immediately adjacent to the A66.

Other key features and designations

11.5.17 Other key features and designations within and beyond the study area are identified in Table 11-6. For information on other related designations, reference should be made to the respective chapters Chapter 7: Biodiversity and Chapter 9: Cultural Heritage of this Environmental Scoping Report (ESR).

Table 11-6: Key features relevant to the assessment of landscape and visual effects

Feature and Scheme(s)	Scoped in/out rationale
Pennine Way National Trail	
Temple Sowerby to Appleby	6.6km north-east. Scoped in.
Bowes Bypass (A66/A67)	0.3 and 3.9km west. Scoped in.
Pennine Journey Long Distance Path	
Temple Sowerby to Appleby	2km north-east and 2.5km east. Scoped in.
Appleby to Brough (Warcop)	1.4km south. Scoped in.
Bowes Bypass (A66/A67)	1km west. Scoped in.
Dales High Way Long Distance Path	
Temple Sowerby to Appleby	5.5km south-east. Scoped in.
Teesdale Way Long Distance Path	
Cross Lane to Rokeby	0.5km north. Scoped in.
Acorn Bank National Trust property	
Temple Sowerby to Appleby	2km west. Scoped in.
Appleby to Brough (Warcop)	1km north. Scoped in.
Ancient woodland and veteran trees (see Chapter 7: Biodiversity, Table 7-5)	
Penrith to Temple Sowerby (Center Parcs)	Adjacent south. Scoped in.
Temple Sowerby to Appleby	Adjacent south. Scoped in.
Appleby to Brough (Warcop)	0.5km north. Scoped in.
Cross Lanes to Rokeby	Adjacent north. Scoped in.

11.5.18 *DMRB LA 107* refers to tranquillity as a factor contributing to the landscape's aesthetic and perceptual characteristics, contributing to the landscape's distinctive character (e.g. pattern, scale, tranquillity, wildness). Tranquillity has also been addressed in the Landscape Institute's *Technical Information Note (TIN) 01/2017* (Landscape Institute, 2017)[162] and will be considered as part of the landscape character assessment as a perceptual aspect.

Visual amenity

11.5.19 Key viewpoints will be identified by the project Landscape Architect and informed by stakeholder consultation, and will be used to assess the available views. The selection of viewpoints will be informed by the ZTV (see Figures 11.5 and 11.6), site visits, and will take into account feedback from stakeholder consultation. Viewpoints are selected by the project landscape architect and are informed by the stakeholder

[162] Landscape Institute (2017) Tranquillity – An overview. Technical Information Note 01/2017, available at: https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2017/02/Tranquillity-An-Overview-1-DH.pdf

consultation to represent visual receptors of varying sensitivity that may be affected by the project. The relatively low-lying topography (see Figure 11.1), presence of intervening vegetation and location of most the schemes in the existing A66 corridor, means that the majority of viewpoints will be within the 7km study area (see Figures 11.5 and 11.6).

11.5.20 Viewpoints will be illustrated with panoramic photography. Viewpoint photography will be undertaken in summer 2021 and winter 2021 to capture both summer and winter views.

11.5.21 The baseline description of viewpoints will form the visual baseline for the assessment. Selected viewpoints will comprise a range of representative, specific and illustrative viewpoints as illustrated in Figures 11.5 and 11.6.

11.5.22 Some of the key identified visual receptors include:

- Residential receptors within key settlements including Penrith, Temple Sowerby, Kirkby Thore, Crackenthorpe, Appleby-in-Westmorland, Warcop, Bowes, Greta Bridge, West Layton, East Layton; and hamlets such as Sandford or isolated residential properties such as Lightmoor Cottages and Mainsgill Farm.
- Recreational users of the extensive PRoW network within the study area, including views from Pennine Journey Long Distance Path and Pennine Way National Trail, and elevated views from the North Pennines AONB designated as Open Access Land, users of Open Country and Registered Common Land, PRoW within the AHLV and users of the National Cycle Network.
- Key views from the A66, representing user experience of the road.
- Transport receptors such as private cars, HGV and other road users.
- Employment receptors such as agricultural workers on surrounding farmland and other places where people work and are likely to have views into the surrounding landscape, e.g. hospitals.

11.5.23 Within the ES, photomontages from key locations will be prepared in accordance with current guidance in *Landscape Institute Technical Guidance Note 06/19 Visual Representation of Development Proposals* (Landscape Institute, 2019)[163].

11.6 Potential impacts

11.6.1 The potential impacts of the project on landscape character and visual amenity will arise during both its construction and operation. Significant effects are most likely to occur in relation to the offline works where the existing landscape and visual amenity is presently unaffected by the A66. Online works could also affect landscape character or visual amenity.

11.6.2 The project would introduce several new and potentially large-scale elements not currently present in the landscape, creating the potential for landscape and/or visual impacts. These potential impacts relate to the loss of existing landscape features, the visibility of new features associated with the project, and how the project affects the perceptual qualities of landscape and visual amenity.

11.6.3 Each scheme will be assessed for potential significant effects during the five year construction period from 2024 to 2029, and at operational years one (2025) and 15 (2044). The construction phase is defined as the temporary activities involved in

[163] Landscape Institute (2019) Visual Representation of Development Proposals – Technical Guidance Note (06/19), available at: https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2019/09/LI_TGN-06-19_Visual_Representation.pdf

building the project. The operational phase is defined as the subsequent permanent presence of the project once constructed and in use by traffic.

Construction

11.6.4 The following are the main potential sources of landscape and visual impacts during construction:

- Vehicles moving machinery and materials to and from the site.
- Machinery movements onsite, including heavy excavators, earthmoving plant, concrete batching plant, and cranes.
- Exposed bare earth over the extent of the works area.
- Structures, earthwork, road surfacing and ancillary works during construction.
- Temporary site compound areas, including site accommodation and parking.
- Temporary soil storage heaps and stockpiles of construction materials.
- Lighting associated with night-time working and compound areas.
- Traffic management measures.
- Temporary works associated with bridge construction operations.
- Demolition and site clearance operations, including loss of landscape features such as dry-stone walls, trees and woodland.

Operation

11.6.5 The following are the main potential sources of landscape and visual impacts during operation:

- A change in nature or composition of views through the introduction of the project and associated structures, including over-bridges, signage and lighting.
- The introduction of new landscape features, including planting and habitat enhancements as part of any landscape mitigation proposals.
- Changes to the existing field patterns.
- Changes in landform due to the introduction of large-scale earthworks, both embankments and cuttings, and the introduction of retaining structures.
- The introduction of new light sources, both static sources such as light columns and dynamic sources, such as from vehicles using the project.
- The introduction of new dynamic landscape features, e.g. vehicles using the proposed route, access roads and overbridges.
- Effects on perceptual qualities of landscape character e.g. tranquillity.

11.7 Design, mitigation and enhancement measures

11.7.1 The project design development is ongoing, and as such the mitigation measures have still to be developed and assessed, and the indicative DCO boundary may continue to evolve. Initial ideas for mitigation measures have been considered, which seek to avoid or reduce any significant adverse effects of the project on the landscape resource and visual amenity. It will be important to prioritise the avoidance or minimisation of vegetation loss through iterative design and engagement.

11.7.2 The design and associated mitigation/enhancements measures will be developed in line with Highways England guidance documents such as *The Road to Good Design* (Highways England, 2018)[164] and *DMRB LD 117 Landscape Design* (Highways

[164] Highways England (2018) The Road to Good Design, available at: https://highwaysengland.co.uk/media/l4ihgawx/strategic-design-panel-the-road-to-good-design.pdf

England, 2020c)[165] and any other relevant guidance to ensure a good fit with the scale and character of the landscape resources.

11.7.3 The design of the project will also be developed in line with principles outlined in The value of design in infrastructure delivery report (National Infrastructure Commission, 2018a)[166] and *Design Principles for National Infrastructure* (National Infrastructure Commission, 2018b)[167].

Construction

11.7.4 Measures to reduce construction effects on landscape character and visual amenity that could be delivered through the design and Environmental Management Plan (EMP) include:

- Establishing site compounds.
- Selecting haul roads and material set down areas away from topographical high points and away from receptors or viewpoints.
- Screening plant or compounds using stored soils or other methods.
- Limiting both temporary and permanent land take, where possible.
- Keeping a tidy site, including stockpiled materials and earthworks.
- Delivery of goods on an as-needed basis.
- Limiting works to daylight hours, with any night, works to be kept to a minimum.
- Using minimal, low level and directional lighting for compound security and night works whilst meeting all safety requirements.
- Retaining existing trees and vegetation and protecting with fencing, where deemed necessary, in accordance with *British Standard (BS) 5837:2012* (British Standards Institute, 2012)[168].
- Maintaining access for walkers, cyclists and horseriders (WCH) to the network of PRoW, open access land, and public viewing points where practicable, through temporary diversions along safe, alternative routes.

Operation

11.7.5 Measures to reduce operational effects on landscape character and visual amenity that could be delivered through the design and EMP include:

- Mitigation planting and earthworks to reduce the long-term effects upon landscape character, by reflecting local topography and landform and thereby helping to integrate the project into the surrounding landscape over time.
- One of the key areas for mitigation would be the conservation and enhancement of the unique character of the North Pennines AONB, reflecting the character of the local landscape.
- Mitigation would be designed to not conflict with the aims and objectives of the North Pennines AONB Management Plan, where relevant.
- Considered use of any required lighting, such as keeping columns to the minimum necessary height and the use of directional luminaires to reduce

[165] Highways England (2020c) Landscape design LD 117, available at: https://www.standardsforhighways.co.uk/dmrb/search/82073bde-ec0c-4d4f-8eeb-afe0ace3c639
[166] National Infrastructure Commission (2018a) The value of design in infrastructure delivery, available at: https://nic.org.uk/app/uploads/NIC_Value-of-Design_double.pdf
[167] National Infrastructure Commission (2018b) Design Principles for National Infrastructure, available at: https://nic.org.uk/app/uploads/NIC-Design-Principles.pdf
[168] British Standards Institute (2012) BS 5837:2012 Trees in Relation to Construction – Recommendations.

impacts on nearby settlements and the more expansive night sky. Measures will be considered to minimise adverse effects on dark skies, tranquillity, and views across the landscape.

- The planting design would contribute to the unique character of the location by responding to existing, typical features of the AONB character types. Examples include well maintained hedgerow patterns and drystone walls, woodland copses and species rich grasslands. There could be areas where planting may be deliberately minimal, reflecting an open character and enabling continuity of views across the landscape. Elsewhere where views to or from the road are of lower value, more planting could be proposed as visual screening.
- The design would also seek to avoid direct loss of and intrusion into areas owned and managed for conservation, open access and recreation.
- The design would seek to achieve landscape, ecological, and heritage benefits through restoration and creating elements and features and improved connectivity.
- The design would have careful regard to siting, operational and other constraints in order to avoid or reduce landscape effects and to provide reasonable mitigation where appropriate.
- The use of sensitive design, detailing, and a quality materials palette for built infrastructure would also help to reduce the operational landscape effects.
- The planting design would be developed through a collaborative design process. This would consider the landscape proposals combined with mitigation relating to visual and audible amenity, biodiversity, heritage, WCH access and waterbodies.
- Planting would include different planting mixes and densities to suit the character of the various landscapes present within the study area, incorporating woodland planting, block planting, native hedgerows and boundary trees, species-rich grassland and wildflower areas as appropriate.
- Use of appropriate boundary treatments such as drystone walls, open fencing, etc. to suit the existing landscape character.
- Development of a landscape design that includes the reinstatement of field patterns where disrupted to reflect the local landscape character and where appropriate to screen the views, utilising false cuttings, embankments and barriers, to minimise the impact on local receptors.
- Planting will be appropriately maintained to ensure that it will mature over time following completion of the project.
- Investigate opportunities to create or restore species-rich flowering grassland or create new woodland and/or wetland habitats.
- Explore opportunities for reduction of noise level and effects on the tranquillity.
- Consider additional opportunities for landscape enhancement outside of the indicative DCO boundary, over and above the mitigation incorporated into the project design.

11.8 Description of the Likely Significant Effects

Overview of Landscape effects (construction)

11.8.1 Construction of the project would lead to the permanent loss of some landscape elements such as tree belts, hedgerows and agricultural land (both arable and pasture). There would also be a permanent alteration to the landform along some schemes. Significant effects may arise as a result of the introduction of construction plant, materials, equipment, use of haul routes and other constructuion activities.

11.8.2 The most prominent elements of the construction of the project are expected to be the by-pass sections of the route and the construction of grade-separated junctions, overbridges, accommodation access tracks and areas involving substantial earthworks.

Overview of Landscape effects (operation)

11.8.3 Potential adverse landscape effects of the operational project would be associated with new or altered highway infrastructure, particularly associated with bypass sections of the route, overbridges, grade-separated junctions, vehicular movements, lighting, gantries, and signage.

11.8.4 The project is likely to affect the setting of the North Pennines AONB and the AHLV. Effects on the Yorkshire Dales National Park will be assessed.

11.8.5 There is the potential for significant adverse effects upon both audible and visual tranquillity, including effects due to permanent lighting. Effects on the loss of existing vegetation, tree belts, woodlands, field pattern will be mitigated as far as possible with replacement planting. Ground modelling will help to integrate the earthworks into the existing landscape where these will be required.

Overview of potential landscape effects by scheme

11.8.6 A summary of the likely significant landscape effects associated with each scheme during construction and operation is presented below. This includes a high level assessment of significance for those Landscape Character Areas that coincide wholly or partly with the 2km buffer. The presence of intervening vegetation, relatively low-lying topography and existing A66 corridor indicate that for those Landscape Character Areas that do not coincide with the 2km buffer, effects on aesthetic and perceptual aspects of landscape character would be limited. However, all Landscape Character Areas in the 7km study area will be considered in the EIA. The effects on Landscape Character Areas will be assessed on a project-by-project basis. The inclusion of Landscape Character Areas will be reviewed for the assessent of cumulative effects with with other permitted developments. The section below is focussed on construction and operational effects in year 15 (2044). The assessment of effects at year 1 will be included in the PEIR and ES.

M6 Junction 40 Penrith

Construction

11.8.7 The widening of the roundabout junction to a three-lane carriageway would result in the need for localised clearance of vegetation and loss of tree belts. Direct construction effects are expected on the following Landscape Character Areas: Urban Area (00), Rolling Fringe (12b), and Intermediate Farmland (06). The effects on these Landscape Character Areas would not be significant due to the small scale of construction centred primarily on the existing junction. Construction at this junction would be similar to the works typically undertaken at motorway junctions. Similarly, the landscape effects on Sandstone Ridge (10) and Limestone Foothills (12c) Landscape Character Areas will not be significant, due to the distance from the project but are proposed for further assessment (see Figures 11.3 and 11.4).

Operation

11.8.8 Operational landscape effects would be restricted to the area of road widening, and it is expected that mitigation planting would sufficiently mitigate the loss of woodland at this location. Planting embedded in the scheme design is anticipated to result in non-significant effects as it would create a similar landscape character to the existing.

11.8.9 The operational effects will be not significant as the project is of small scale and extent and is not anticipated to affect the broader characteristics of Landscape Character Areas. However the operational effects are proposed for further assessment within the EIA.

M6 Junction 40 to Kemplay Bank Roundabout

Construction

11.8.10 Construction activities would be introduced along the proposed on-slip and off-slip roads for the A66. The works would involve landform alteration to accommodate the underpass. Some sections of tree belts and hedgerows may be permanently lost to accommodate this scheme. There are opportunities for the introduction of environmental design measures to compensate for the loss of vegetation.

11.8.11 There may be significant construction effects on the Urban (00) and Intermediate Farmland (06) Landscape Character Areas. The landscape effects during construction on the Rolling Fringe (12b) Landscape Character Area would be indirect and likely not significant, however due to intervisibility with this scheme these effects will be assessed further in the EIA. The indirect effects on the Sandstone Ridge (10) Landscape Character Areas and Broad Valleys (08b) will have minimal visual relationship with the scheme, but are proposed for further assessment (see Figures 11.3 and 11.4).

Operation

11.8.12 During operation, the proposed underpass and off-slip roads would represent a small-scale alteration to the existing landscape character. The loss of vegatation would be compensated through the provision of mitigation planting. The operational effects on the Urban (00) and Intermediate Farmland (06) Landscape Character Areas will be assessed in the EIA, although they are unlikely to be significant. The effects on Rolling Fringe (12b) Landscape Character Area are likely to be not significant, but due to intervisibility with the Scheme are proposed for further assessment.

11.8.13 The indirect operational effects on the Sandstone Ridge (10) and Broad Valleys (08b) Landscape Character Areas will have minimal visual relationship with the scheme, resulting in likely not significant effects, but are proposed for further assessment. (see Figures 11.3 and 11.4).

Penrith to Temple Sowerby (Center Parcs)

Construction

11.8.14 Construction works associated with dualling between Penrith and Temple Sowerby, and the construction of a new junction at Center Parcs combined with the construction of smaller junctions would introduce new construction features into the landscape such as machinery, compounds, material set down areas, and temporary soil storage areas. Construction would result in the loss of some sections of tree belts, alteration to landscape pattern and landform.

11.8.15 During construction, direct effects are likely to occur on the following Landscape Character Areas: Intermediate Farmland (06), Broad Valleys (08b), and Sandstone Ridge (10). These are likely to be significant apart from Sandstone Ridge (10) Landscape Character Area, where effects are not likely to be significant. However, due to intervisibility of some areas within the Sandstone Ridge Landscape Character Area, the effects are proposed for further assessment in the EIA. The effects on Urban Area (00) and Rolling Fringe (12b) will have very little visual relationship with the scheme, but the effects are proposed for further assessment (see Figures 11.3 and 11.4).

Operation

11.8.16 During operation, the junction proposed at Center Parcs would add a new structure into the existing highway corridor, reinforcing a pattern of road infrastructure alongside other smaller junctions enabling access from residential properties and businesses. There are good opportunities to mitigate effects through planting embedded into the design, and it is not likely that Landscape Charater Areas will be affected significantly. However, effects on the following Landscape Character Areas are proposed for further assessment: Intermediate Farmland (06), Broad Valleys (11), and Sandstone Ridge (10).

11.8.17 The operational effects on Urban Area (00) and Rolling Fringe (12b) Landscape Character Areas will be assessed within EIA, however due to the distance and minimal visual relationship with the scheme resulting in likely not significant effects (see Figures 11.3 and 11.4).

Temple Sowerby to Appleby

11.8.18 It should be noted that this scheme is currently subject to further alternative alignment routes assessment, in part due to the potential impacts associated with the crossing of Trout Beck. Alternative alignments under consideration include crossing Trout Beck further to the east, further to the west (closer to Kirkby Thore) or a largely online route to the south of Kirkby Thore. The process and outcome of this assessment will be set out in the ES, along with a detailed baseline description for the selected route.

Construction

11.8.19 The construction of this scheme would involve a substantial amount of activity along its entire length. Large scale construction activities would result in a temporary and short-term but substantial change to the landscape character including alteration to landscape pattern, landform and land use, and altering the landscape setting around Kirkby Thore and Crackenthorpe.

11.8.20 Direct construction effects are predicted on the Broad Valleys (08b) and Intermediate Farmland (06) Landscape Character Areas and these effects are likely to be significant. Effects on the Intermediate Moorland Plateau (09), Sandstone Ridge (10) and Foothills (11a) Landscape Character Areas would be indirect and may be significant due to visibility of the scheme (see Figures 11.3 and 11.4) these are proposed for further assessment in the EIA.

Operation

11.8.21 Once operational, new highway infrastructure elements would permanently alter the landscape setting around these villages. The introduction of mitigation measures would help to integrate the scheme into the surrounding landscape. The effects on Broad Valleys (08b) and Intermediate Farmland (06) are likely to be significant. Effects on the Intermediate Moorland Plateau (09), Sandstone Ridge (10) and Foothills (11a) Landscape Character Areas are unlikely to be significant in operation but are proposed for further assessment.

Appleby to Brough (Warcop)

11.8.22 As with the Temple Sowerby to Appleby section, this scheme is also subject to further alternative alignment routes assessment due to its close interaction with the North Pennines AONB. Alternative alignments immediately north of Warcop and an alternative tie-in further east along the existing A66 are under consideration. The process and outcome of this assessment will be set out in the ES, along with a detailed baseline description for the selected route.

Construction

11.8.23 The construction of this scheme would involve a substantial amount of activity along its entire length. Construction would require additional land take associated with the loss of some tree belts, localised changes to the landscape pattern and landform. Construction activities including machinery, compounds, material set down areas and material stockpiles would be introduced.

11.8.24 During construction, direct effects are predicted on the Foothills (11a) and Broad Valleys (08b) Landscape Character Areas. These effects are likely to be significant and are proposed for further assessment in the EIA. Indirect construction effects on Scarps (13a) and Intermediate Moorland Plateau (09) Landscape Character Areas are proposed for further assessment due to the potential views of the scheme available as there may be a significant effects.

Operation

11.8.25 Once operational, the landscape character would be permanently altered through the introduction of junctions along the dualled section of the A66. While there are good opportunities to mitigate the adverse effects on landscape character, through the introduction of embedded mitigation measures, the operational effects may be significant for the Broad Valleys (08b) and Foothills (11a) Landscape Character Areas. The potential effects on the Scarps (13a), and Intermediate Moorland Plateau (09) Landscape Character Areas are not likely to be significant, however the effects are proposed for further consideration in the EIA due to the intervisibility.

11.8.26 The effects on the North Pennines AONB to the north of the scheme will be considered. The presence of designations will also inform the assessment of sensitivity.

Bowes Bypass (A66/A67)

11.8.27 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The process and outcome of this assessment will be set out in the ES, along with a detailed baseline description for the selected route.

Construction

11.8.28 Construction would be centred on the existing road alignment and widening of the carriageway to the north of Bowes. The key construction effects would include loss of some sections of tree belts and hedgerows, and localised alteration to the landscape pattern and landform. Construction would introduce new features such as construction machinery, compounds, fencing, and activities such as formation of earthworks and underpass construction. Localised changes to the landscape character at the periphery of the Rokeby Park Registered Park and Garden would arise due to construction activities.

11.8.29 During construction direct effects are predicted on the Bowes, Lower Greta and Mid Greta Valley Landscape Character Areas, and these effects are proposed for further assessment as the effects are likely to be significant. The Deepdale Moorland Fringe, Cotherstone Moor, Boldron and Lartington, Barningham, Hope and Scargill Moors, and Stainmore, Landscape Character Areas would be affected indirectly by the scheme, but due to the intervisibility between some areas they are proposed for further assessment, although the effects are unlikely to be significant. The effect upon Sleightholme and Greta Fringes Landscape Character Area is likely to be not significant, due to very limited intervisibility with the scheme as illustrated by the ZTV shown on Figures 11.5 and 11.6.

Operation

11.8.30 Once operational, apart from the widening of the A66 a new eastbound slip road will be introduced alongside Bowes Junction/A67 overbridge and East Bowes Accommodation overbridge. These permanent alterations to the A66 corridor will alter the landscape character locally by expanding the road infrastructure pattern, although there are good opportunities to mitigate adverse effects through introduction of embedded mitigation measures on landscape character.

11.8.31 The direct effects are predicted on the Bowes, Lower Greta and Mid Greta Valley Landscape Character Areas, and these effects are proposed for further assessment, although these are unlikely to be significant. The other Landscape Character Areas coinciding with the 2km buffer would be affected indirectly by the scheme, but due to the intervisibility between some areas they are proposed for further assessment with the exception of Sleightholme and Greta Fringes Landscape Character Area from which very limited intervisibility is indicated by the ZTV shown on Figures 11.5 and 11.6. The indirect effects on these Landscape Character Areas are unlikely to be significant but will be assessed in the EIA.

11.8.32 The effects on the North Pennines AONB designation to the north of the scheme will be considered separately to the effects on the Landscape Character Areas, however the presence of the designation will inform the assessment of value and susceptibility.

Cross Lanes to Rokeby

11.8.33 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The process and outcome of this options assessment will be set out in the ES, along with a detailed baseline description for the selected route.

Construction

11.8.34 The scheme would introduce construction activities into the rural setting of the A66. Construction, although temporary and short term, would alter the key characteristics of the landscape character along the A66.

11.8.35 Direct construction effects are predicted on the Boldron and Lartington, Barninghham, Brignal and Rokeby and Moorhouse and Gillbeck Landscape Character Areas and the effects are proposed for further assessment and are likely to be significant. The effects on the Lower Greta, Newsham and Cleatlam, River Tees, Southern Tees Vale: Hutton Magna Landscape Character Areas are likely to be not significant due to minimal visual relationship with the scheme (see Figures 11.5 and 11.6).

Operation

11.8.36 Once operational, the introduction of the new westbound carriageway and the addition of a new junction at Cross Lanes and Rokeby, and other junctions, would alter the landscape character locally, the existing landscape pattern and landform, combined with the addition of new structures that could detract from the rural character.

11.8.37 The effects on the Boldron and Lartington, Barninghham, Brignal and Rokeby and Moorhouse and Gillbeck Landscape Character Areas are proposed for further assessment and the effects are likely to be significant in a localised area. The effects on the Lower Greta, Newsham and Cleatlam, River Tees, Southern Tees Vale: Hutton Magna Character Areas are likely to be not significant as there is minimal visual relationship with the scheme (see Figures 11.5 and 11.6).

11.8.38 The scheme would cross Rokeby Registered Park and Garden. The effects on this designation will be considered separately to the effects on the landscape character However, the presence of the designation will inform the assessment of landscape character sensitivity.

Stephen Bank to Carkin Moor

Construction

11.8.39 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The process and outcome of this assessment will be set out in the ES, along with a detailed baseline description for the selected route.

11.8.40 The scheme would alter locally the existing landscape pattern and introduce construction activities into the rural character of the adjacent landscape. Construction works would require land take, would alter the local landform, and would result in a loss of vegetation, including hedgerows and a section of tree belt.

11.8.41 Construction is expected to result in significant effects on the Moors Fringe Landscape Character Area and a localised area of Southern Tees Vale: Hutton Magna Landscape Character Area.

Operation

11.8.42 Once operational, the introduction of a new dual carriageway and new junction at Moor Lane would result in a local alteration to the landscape character that would change perception of it locally. The effects on the Moors Fringe and Southern Tees Vale: Hutton Magna Landscape Character Areas are proposed for further assessment. While there are good opportunities to mitigate effects on landscape character through the introduction of embedded mitigation measures, operational effects are likely to be significant.

A1(M) Junction 53 Scotch Corner

Construction

11.8.43 The construction works will result in localised loss of vegetation around one of the approaches to the junction and the introduction of construction activity, including construction machinery.

11.8.44 The Moors Fringe Landscape Character Area will be directly affected through construction activities, but the short term and temporary changes to the landscape will not be significant due to the small extent of the area affected and small scale of alterations. The construction effects on Vale Farmland with will be indirect and distant with little intervisibility, and are not predicted to be significant. Landscape effects from this scheme are therefore proposed to be scoped out of the EIA.

Operation

11.8.45 During operation, the new elements of the scheme will expand the existing pattern of landscape infrastructure very slightly. The new scheme features will be similar to those already present at the junction. The integration of embedded mitigation as part of the scheme design is expected to result in non-significant effects on the Moors Fringe and Vale Farmland Landscape Character Area. The landscape effects from this scheme are therefore proposed to be scoped out of the EIA.

11.8.46 Table 12-7 summarises the outcomes of the reasoning provided above for scoping in or out of relevant Landscape Character Areas. It should be noted that there are circumstances in which likely significant effects are not expected but further assessment in the EIA is still proposed. Where applicable, the reasoning for this is explained in the narrative above.

Table 11-7: Likely significant landscape effects to be scoped in/scoped out

Landscape Character Areas	Likely significant construction effects?	Likely significant operational effects?	Scoped in (✓)/ Scoped out (X)
M6 Junction 40 Penrith			
Urban Area (00)	No	No	✓
Intermediate Farmland (6)	No	No	✓
Sandstone Ridge (10)	No	No	✓
Rolling Fringe (12b)	No	No	✓
Limestone Foothills (12c)	No	No	✓
M6 Junction 40 to Kemplay Bank Roundabout			
Urban Area (00)	Yes	No	✓
Intermediate Farmland (06)	Yes	No	✓
Rolling Fringe (12b)	No	No	✓
Broad Valleys (08b)	No	No	✓
Sandstone Ridge (10)	No	No	✓
Penrith to Temple Sowerby (Center Parcs)			
Intermediate Farmland (06)	Yes	No	✓
Broad Valleys (08b)	Yes	No	✓
Sandstone Ridge (10)	No	No	✓
Urban (00)	No	No	✓
Rolling Fringe (12b)	No	No	✓
Temple Sowerby to Appleby			
Broad Valleys (08b)	Yes	Yes	✓
Intermediate Farmland (06)	Yes	Yes	✓
Foothills (11a)	Yes	No	✓

Landscape Character Areas	Likely significant construction effects?	Likely significant operational effects?	Scoped in (✓)/ Scoped out (X)
Intermediate Moorland Plateau (09)	Yes	No	✓
Sandstone Ridge (10)	Yes	No	✓
Appleby to Brough (Warcop)			
Foothills (11a)	Yes	Yes	✓
Broad Valleys (08b)	Yes	Yes	✓
Scarps (13a)	No	No	✓
Intermediate Moorland Plateau (09)	No	No	✓
Bowes Bypass (A66/A67)			
Bowes	Yes	No	✓
Boldron and Lartington	Yes	No	✓
Barninghham, Hope and Scargill Moors	Yes	No	✓
Cotherstone Moor	No	No	✓
Deepdale Moorland Fringe	No	No	✓
Lower Greta	No	No	✓
Mid Greta Valley	No	No	✓
Sleightholme and Greta Fringes	No	No	✓
Stainmore	No	No	✓
Cross Lane to Rokeby			
Boldron and Lartington	Yes	Yes	✓
Barninghham, Brignal and Rokeby	Yes	Yes	✓
Moorhouse and Gillbeck	Yes	Yes	✓
Lower Greta	No	No	✓

Landscape Character Areas	Likely significant construction effects?	Likely significant operational effects?	Scoped in (✓)/ Scoped out (X)
Newsham and Cleatlam	No	No	✓
River Tees	No	No	✓
Southern Tees Vale: Hutton Magna	No	No	✓
Stephen Bank to Carkin Moor			
Moors Fringe	Yes	Yes	✓
Southern Tees Vale: Hutton Magna	Yes	Yes	✓
A1(M) Junction 53 Scotch Corner			
Moorland Fringe	No	No	X
Vale Farmland	No	No	X

Visual Effects

11.8.47 The effects on visual receptors will be assessed on a scheme-by-scheme basis in the EIA. The identification of visual receptors will be informed by the ZTV and consultation with stakeholders (see Figures 11.5 and 11.6). The ZTV helps to identify locations where views are likely to be available and the schemes where there will be no views. The sections below describe the visual effects that are likely during construction and operation.

Visual effects - construction

11.8.48 During the construction period, several sensitive receptor groups, including residential properties and users of recreational facilities and PRoW, are likely to experience short-term adverse visual effects. Many of these visual effects are likely to be significant, particularly for a range of visual receptors located close to the project and some visual receptors located on more elevated landform of the North Pennines AONB or raised landform of the Eden Valley.

11.8.49 During construction, views would be altered through the introduction of construction plant, materials, and equipment that would be required to widen the A66, construct the overbridges and accommodation overbridges. The visual impact is likely to result from the following construction activities and the introduction of construction elements:

- Opening up of the views through the removal of vegetation
- Movement of construction plant
- Use of cranes to construct overbridges
- Presence of contractor compounds
- Temporary lighting needed for the works
- Stockpiled soil and material set down areas
- Diversion of traffic

11.8.50 The most visually prominent elements of the project are expected to be by-pass sections of the route and the construction of grade-separated junctions, overbridges, accommodation access tracks and areas involving substantial cut and fill operations.

Visual effects - operation

11.8.51 Due to the sensitivity of visual receptors within a predominantly rural setting, as well as elevated views from parts of the surrounding area such as North Pennines AONB, there is the potential for impacts upon visual receptors during operation.

11.8.52 The potentially significant adverse effects relating to views and visual tranquillity from sensitive visual receptors are likely to arise primarily in year one. Effects would arise where views of the project, including overbridges, junctions, access tracks, or by-pass sections, cannot be fully mitigated through the introduction of mitigation planting. This will relate to some visual receptors located close to the project and also those located on the elevated land of North Pennines AONB, the AHLV, or rising landform of the valleys elsewhere.

11.8.53 Planting along the route, where appropriate, would break up the views to passing traffic and the road itself. However, not all visual effects are likely to be fully mitigated by planting.

11.8.54 As highlighted above, representative receptors are subject to consultation with stakeholders and will form the basis of the assessment of visual effects. All schemes are proposed for further assessment of effects on views in construction and operation years 1 and 15, except for A1(M) Junction 53 Scotch Corner. The rationale for scoping this scheme out from further assessment is presented below.

A1(M) Junction 53 Scotch Corner

11.8.55 The junction is surrounded by a range of business receptors including Scotch Corner Services, Scotch Corner Holiday Inn, Holiday Inn Darlington and others. The views from Scotch Corner Caravan Park, located to the south-west of the junction, are screened by a woodland belt. The woodland belt between the junction and village of Middleton Tyas screens the views in and out of the village.

Construction

11.8.56 The construction activity for this scheme would be very much centred on the existing roundabout junction. Views of construction activity would be temporary, reversible and of small scale as the construction would be similar in dynamic with the existing traffic around the junction and is typical for the highway environment where maintenance or small scale construction occurs frequently. The visual effects would therefore not be significant.

Operation

11.8.57 Once operational, the widening of the existing junction approach would result in slight changes in the views similar to the existing baseline. The integration of embedded mitigation as part of the scheme design is expected to result in non-significant effects on the views available from nearby visual receptors would be similar to the existing baseline. Therefore the assessment of effects on views is proposed to be scoped out of the EIA.

Views from the road

11.8.58 The A66 is located within a landscape that offers panoramic views not only towards the road corridor but also from the road corridor. Key sections of road will be identified and shown on a map and, where practicable, viewpoint photography undertaken from nearby publicly accessible locations (e.g. PRoW, minor roads, etc.) that represent or indicate the experience of road users, and how it might change as a result of the project.

11.8.59 Maps and photographs would be accompanied by a narrative that describes the road user experience, identifies the potential for change and discusses any design mitigation as part of the EIA. The purpose would not be to assess significance of effects, but to use the principles of *DMRB LA 107* and *GLVIA3* to undertake a qualitative assessment of potential change and identify appropriate design interventions and mitigation.

11.9 Assessment Methodology

Landscape assessment methodology

11.9.1 Assessment of effects on landscape receptors requires consideration of the nature of the receptor (sensitivity) and the nature of the effect on those receptors (magnitude of effect), and how sensitivity and magnitude of effect combine to form a professional judgement on the overall level of effect and as to whether it is significant or not.

Landscape sensitivity

11.9.2 As stated in *DMRB LA 107*, sensitivity is a combination of a landscape receptor's susceptibility to change and the value attributed to the receptor.

Susceptibility of landscape receptors

11.9.3 *DMRB LA 107* highlights that the assessment of susceptibility to change should be tailored to the project. *GLVIA3* defines susceptibility as *"the ability of the landscape receptor (whether it be the overall character or quality/condition of a particular type or area, or an individual element and/or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed scheme without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies" (paragraph 5.40).*

Value of landscape receptors

11.9.4 Assessment of sensitivity also includes assessment of a receptor's value. This will be undertaken with the reference to designation and the level of policy importance that they signify and the application of criteria that indicates value, such as landscape or scenic quality, conservation interest, recreational value, or perceptual and cultural associations.

Magnitude of landscape effect

11.9.5 Assessment of the magnitude of an effect (change) for landscape receptors requires judgements on the size and scale of the effect of the proposed change, the geographical extent over which the change will be experienced, its duration and reversibility. Magnitude of effect will be determined for each phase of the project during construction and operation (year 1 and year 15).

Size and scale of landscape change

11.9.6 The size and scale of landscape change will depend on the degree to which a landscape receptor is changed by the project, such as the removal or addition of new features within the landscape, whether these are perceived as typical, and how the change will affect the key characteristics of the landscape.

Geographical extent of landscape effect

11.9.7 To establish the geographical extent of an effect, a judgement will be made about the extent of effects. These will be described as local (small extent) with limited effects on the wider landscape character; where changes are perceived across a wider area (medium extent); or where changes have a widespread influence and are perceived across a wide area (large extent).

Duration of landscape effect

11.9.8 The duration will be reported as temporary, short term, medium term or long term

Reversibility of landscape effect

11.9.9 Reversibility relates to whether the change is likely to be reversible, such as construction effects which could mostly be recorded as reversible. The permanent presence or removal of built structures would be considered 'not reversible'.

Significance of landscape effect

11.9.10 The susceptibility and value (sensitivity) of each receptor to the proposed changes will be combined with judgements on size and scale, geographical extent, duration and reversibility of effects (magnitude of effect) to provide an overall judgement for the significance of identified landscape effects.

Visual assessment methodology

11.9.11 The visual baseline will be recorded with reference to selected viewpoints that may experience views of the project. The nature of existing views and visual amenity will be described. Viewpoints will be recorded as representative, specific and illustrative viewpoints. The locations of viewpoints and photomontages will be determined by a qualified Landscape Architect in consultation with relevant stakeholders.

11.9.12 Effects on visual receptors require consideration of the nature of the receptor (sensitivity) and the nature of the effect on those receptors (magnitude of effect (change), which are combined using professional judgement.

11.9.13 The process for assessing the significance of effects is the same for both the construction and operational phases. It requires professional judgment to establish the sensitivity and magnitude of effects to determine the significance. The significance of effects will be assessed for winter year 1 (opening year) and summer and winter year 15 (design year).

Visual sensitivity

11.9.14 Visual sensitivity is a combination of a visual receptor's susceptibility to change and its value, with magnitude of effect being recorded as a combination of the size/scale, geographical extent and duration of the proposed change (*DMRB LA 107* para 3.4).

Susceptibility of visual receptors

11.9.15 *DMRB LA 107* identifies that the assessment of susceptibility to change should be tailored to the project. *GLVIA3* states that the susceptibility of different visual receptors to changes in views and visual amenity relates to *"the occupation or activity of people experiencing the view at particular locations; and the extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at particular locations"* (paragraph 6.32).

11.9.16 The assessment will focus on the likely capacity of a visual receptor to accommodate changes as a result of the construction and operation of large-scale road infrastructure in the view or visual resource. These changes include the widening of the A66, introduction of junctions, loss of existing features, or changes in the composition of the view or visual resource such as through the loss of woodland and hedgerows, changes in topography or inclusion of new features such as overbridges, accomodation access tracks and other elements of road infrastructure.

11.9.17 *GLVIA3* (para 6.33) states that visual receptors most susceptible to change include residents or communities where views contribute to the landscape setting enjoyed, people engaging in outdoor recreation (such as users of PRoW) whose attention or interest is likely to be focused on the landscape and on particular views, and visitors to heritage assets, or other attractions where views of the surrounding are an important contributor to the experience.

11.9.18 Visual receptors with lower susceptibility to change include travellers on roads, rail and other transport routes, people engaged in outdoor sport or recreation which does not involve or depend upon appreciation of views of the landscape, and people at their place of work.

Visual value

11.9.19 The assessment of visual value will take into consideration landscape designations, formal viewpoints identified on Ordnance Survey (OS) maps or other views identified in local policy documents or management plans that indicate value, such as aesthetic or scenic quality, or special qualities of the views.

11.9.20 Other indicators of visual value include the inclusion of viewpoints in guidebooks or tourist maps, or through the provision of facilities for their enjoyment (such as parking places, sign boards and interpretive materials) or reference to them in literature or art.

Magnitude of visual effect

11.9.21 To report on the nature of effect (magnitude of effect) for each visual receptor, judgements will be made in terms of the size and scale of effect, its geographical extent, duration and reversibility. Overall magnitude of effects will be recorded as either adverse, beneficial or neutral.

Size/scale of visual change

11.9.22 The size and scale of change will depend on the degree to which the view or visual amenity is changed by the project such as through the removal or addition of new features and whether these are perceived as typical.

Geographical extent of visual effect

11.9.23 To establish a geographical extent of visual effects, a judgement will be made about how far ranging the effects are likely to be. These will be described as: locally (small extent) where there are only a few locations from where the project can be glimpsed or changes are experienced by few people; wider area (medium extent) where there are several locations where similar views can be gained.

Duration of visual effect

11.9.24 The duration of visual effects will be indicated.

Reversibility of visual effect

11.9.25 Reversibility relates to whether the change is likely to be reversible, for instance most construction effects could be recorded as 'reversible'. The permanent presence or removal of built structures would be considered 'not reversible'

Significance of effect

11.9.26 Final judgements on the likely significance of visual effects will combine judgements of the sensitivity of each visual receptor and the magnitude of their visual effect as a result of the project. Similarily the effects on landscape receptors will combine judgments on landscape sensitivity with magnitude of change to inform the significance of effects.

11.9.27 The susceptibility and value (sensitivity) of receptors to the proposed changes will be combined with judgements on size and scale, geographical extent, duration and reversibility of effects (magnitude of effect) to provide an overall judgement for each identified effect. This will involve making an informed professional assessment of the overall level of each effect, as set out in *GLVIA3*.

11.9.28 Levels of effect will be identified as either neutral, slight, moderate, large or very large. Major and moderate effects will be judged to be significant, any effect assessed to have a level of effect less than moderate is considered not to be significant.

11.9.29 *DMRB LA 107* states that the approach to deriving impact significance should be *"based on the significance matrix included in the Environmental assessment methodology section of LA 104 and include evidence to support any professional judgements that have been made"* (paragraph 3.26).

Assessment of effects on the North Pennines AONB area

11.9.30 The assessment of effects on the North Pennoine AONB designation will assess the effects on key special qualities of the AONB during each stage of the development construction, year 1 and year 15. The special qualities of the AONB area are described within the *Pennine AONB Management Plan 2019-24* and these include:

- "*is recognised as one of the most tranquil parts of England;*
- *has truly dark skies and is the darkest mainland AONB;*
- *is a distinctive landscape of demonstrable quality;*
- *has almost 40% of the UK's upland hay meadows;*
- *has outstanding geology recognised by its UNESCO Global Geopark designation;*
- *has iconic birds and other wildlife (eg. 80% of England's black grouse, 22,000 pairs of breeding wading birds, red squirrels), and;*
- *has a rich industrial heritage, including lead mining/quarrying."*

11.9.31 The effects on the setting of the North Pennines AONB area defined within the *AONB Management Plan* as: *"The term 'setting' is used to refer to areas outside the AONB where development and other activities may affect land within an AONB. Its extent will vary depending upon the issues considered but some can be mapped, for example, the impact of development on views into and out of the AONB."*

11.9.32 The effects on the setting of the AONB area will be assessed based on desktop studies, the ZTV, verified by field surveys and informed through the assessment of effects on visual receptors located between the Schemes and the AONB area.

Cumulative effects

11.9.33 *DMRB LA 104* requires assessment of cumulative effects, which include those from:

- the combined impact of a number of different environmental factors – different impacts on a single receptor/resource; and/or
- the combined impact of a number of different Schemes within the vicinity (in combination with the environmental impact assessment) on a single receptor/resource.

11.9.34 The combined landscape and visual impacts of the project with other developments will be assessed as part of the EIA .

11.10 Assessment assumptions and limitations

11.10.1 This chapter is based on currently available information and draws on assessment work undertaken by others at earlier stages of the project. The landscape and visual effects assessment will build upon this previous work to inform the ES chapter.

11.10.2 All viewpoints considered within the assessment will be located on publicly accessible land.

11.10.3 The assessment will not consider the effects of the project on the setting of heritage assets. Where appropriate, views from publicly accessible heritage assets may inform the assessment of visual effects.

11.10.4 The night-time effects of the project will be considered further as part of the EIA.

11.10.5 The effects on views from residential properties will be undertaken using representative proxy locations from publicly accessible land. This will assess a change to the visual amenity likely to be experienced by occupants at individual residential properties. A suite of proposed viewpoints representing residential receptors is subject to ongoing consultation.

11.10.6 No detailed construction information such as compounds, storage and duration is likely to be available to inform the EIA. Therefore, judgements will be made about potential impacts based on the construction information available at the time of writing.

11.10.7 At this stage, detailed designs have not been produced for each scheme and there remains some alternative alignment routes assessment ongoing for some schemes. As a result, it is not possible to fully assess the likely impacts of the project on the landscape. All assumptions and any remaining areas of uncertainty will be documented in the ES.

Table 11-8: Landscape and Visual scoping criteria from *DMRB LA 107* - construction

	M6 Junction 40 Penrith	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Landscape:										
1) is the project likely to affect designated landscapes (statutory or local designation)?	N	N	N	N	Y	Y	Y	N	N	Y/N
2) is the project likely to affect the distinctiveness of a landscape character area or type?	N	N	N	N	N	N	N	N	N	N
3) is the project likely to affect national, regional or local characteristics or distinctive features?	N	N	Y	Y	Y	Y	Y	N	N	Y/N
4) is the project likely to affect the condition or quality of a landscape?	N	N	Y	Y	Y	Y	Y	N	N	Y/N
5) is the project likely to affect the intrinsic character, qualities and local identity of the urban environment (sense of place)?	N	N	N	N	N	N	N	N	N	N
Visual:										
1) is the project likely to affect receptors (individuals or range of people) views	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

	M6 Junction 40 Penrith	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
and the visual amenity of the area?										
2) is the project likely to affect the sensitivity of views to and from designated and/or valued landscapes, or from public rights of ways, public open spaces or from national trials?	N	Y	Y	Y	Y	Y	Y	Y	N	Y/N
3) is the project likely to affect a range of viewpoints and nature of views from which the project is visible?	N	Y	Y	Y	Y	Y	Y	Y	N	Y/N
4) is the project likely to generate significant visual effects (daytime and night-time)?	N	Y	Y	Y	Y	Y	Y	Y	N	Y
Key mitigation	The key mitigation measures during construction would include retention of existing vegetation in accordance with current best practice. Where bunds are proposed as part of the permanent works, they would be constructed as early as is practicable to provide screening to the construction work. Land used temporarily, such as for compounds, haul roads, regrading areas, would be returned to a condition suitable for the continuation of its original use. This would include the appropriate replanting of hedgerows and trees, where removal could not be avoided.									

	M6 Junction 40 Penrith	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Proposed Scope (In)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) Ref. (11.8.7-11.8.9)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) Ref. (11.8.10-11.8.13)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7), Ref. (11.8.14-11.8.17)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) Ref. (11.8.18-11.8.21)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7), (11.8.22-11.8.26)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) (11.8.27-11.8.32)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) (11.8.33-11.8.38)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) (11.8.39-11.8.42)	-	Y/N
Proposed Scope (Out)	Effects on Lake District National Park Ref. (11.5.11) Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Visual Assessment of visual effects. Landscape Effects on relevant Landscape Character Areas (Table 11-8) Ref. (11.8.43 – 0)	Y/N

Table 11-9: Landscape and Visual scoping criteria from *DMRB LA107* - operation

	M6 Junction 40 Penrith	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Landscape:										
1) is the project likely to affect designated landscapes (statutory or local designation)?	N	N	N	Y	Y	Y	Y	N	N	Y/N
2) is the project likely to affect the distinctiveness of a landscape	N	N	N	N	N	N	N	N	N	N

	M6 Junction 40 Penrith	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
character area or type?										
3) is the project likely to affect national, regional or local characteristics or distinctive features?	N	N	Y	Y	Y	Y	Y	N	N	Y/N
4) is the project likely to affect the condition or quality of a landscape?	N	N	Y	Y	Y	Y	Y	N	N	Y/N
5) is the project likely to affect the intrinsic character, qualities and local identity of the urban environment (sense of place)?	N	N	N	N	N	N	N	N	N	N
Visual:										
1) is the project likely to affect receptors (individuals or range of people) views and the visual amenity of the area?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2) is the project likely to affect the sensitivity of views to and from designated and/or valued landscapes, or	N	Y	Y	Y	Y	Y	Y	Y	N	Y/N

	M6 Junction 40 Penrith	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
from public rights of ways, public open spaces or from national trials?										
3) is the project likely to affect a range of viewpoints and the nature of views from which the project is visible?	N	Y	Y	Y	Y	Y	Y	Y	N	Y/N
4) is the project likely to generate significant visual effects (daytime and night time)?	N	Y	Y	Y	Y	Y	Y	Y	N	Y/N
Key mitigation	Potential landscape and visual mitigation of operational effects include the development and integration of a landscape and environmental strategy for the proposed Scheme that is responsive to the landscape setting of the Eden Valley and the North Pennine AONB, enhances biodiversity and adopts an uncluttered approach to design and materials. The strategy would also seek to identify opportunities to mitigate impacts on the physical landscape. This would include minimising cut and fill adjustments of the natural topography or increasing the footprint and reducing the gradient of cut and fill operations to allow natural contours that flow into the surrounding landscape. The preferred approach would depend on the immediate landscape context and constraints of other environmental and heritage factors. The proposed planting would be focussed on restoration of existing landscape pattern and screening, where this would be in line with the landscape setting and views in and out of the road corridor.									
Proposed Scope (In)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) Ref. (11.8.7-11.8.9)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) Ref. (11.8.10-11.8.13)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7), Ref. (11.8.14-11.8.17)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) Ref. (11.8.18-11.8.21)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7), (11.8.22-11.8.26)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) (11.8.27-11.8.32)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) (11.8.33-11.8.38) Effects on Greta Bridge Conservation Area (Table 11-5)	Visual Effects on representative visual receptors Landscape Effects on relevant Landscape Character Areas (Table 11-7) (11.8.39-11.8.42)	-	Y/N

	M6 Junction 40 Penrith	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Proposed Scope (Out)	Effects on Lake District National Park Ref. (11.5.10) Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Effects on Conservation Area (Table 11-5)	Visual Assessment of visual effects. Landscape Effects on relevant Landscape Character Areas (Table 11-8) Ref. (11.8.43–0) Effects on Conservation Area (Table 11-5)	Y/N

12 Materials and Waste

12.1 Introduction

12.1.1 This chapter outlines the scope of the assessment to be undertaken for material assets and waste.

12.1.2 There may be interrelationships related to the potential effects on material assets and waste and other disciplines. Therefore, please also refer to the following chapters:

- Chapter 8: Climate
- Chapter 10: Geology and Soils
- Chapter 15: Road Drainage and the Water Environment

12.1.3 The methodology used will follow the requirements of *Design Manual for Roads and Bridges (DMRB) LA 110 Material Assets and Waste* (Highways England, 2019)[169].

12.2 Key questions for scoping

1. Do you agree with the proposed scope of the material assets and waste assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the material assets and waste assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments?
4. Are there any other key issues or aspects relevant to the material assets and waste assessment that you wish to bring to the attention of the design and assessment team?
5. Do you consider assessing cut and fill balance at a) the scheme level b) work package c) route wide appropriate?
6. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

12.3 Study area

12.3.1 Two interrelated study areas have been identified and defined as per *DMRB LA 110*. The first study area is related to the area of the project where construction materials will be consumed. The second study area is related to the area where the main construction materials will be sourced and construction waste will be treated or disposed. The study areas have been updated from those considered in the Option Selection stage *Environmental Assessment Report (EAR)*[170] for the material assets and waste assessment.

12.3.2 Study area 1 is the area within the indicative Development Consent Order (DCO) boundary, as within these areas construction materials would be consumed (used, re-used and recycled) and would include any temporary storage and compound

[169] Highways England (2019) Material assets and waste LA 110, available at: https://www.standardsforhighways.co.uk/dmrb/search/6a19a7d4-2596-490d-b17b-4c9e570339e9
[170] Highways England (2018) A66 PCF Stage 2 Environmental Assessment Report

areas. Study area 2 will comprise waste infrastructure in the regions of the North East consisting of the local authority areas set out in

12.3.3

12.3.4

12.3.5 Table 12-7, the North West consisting of the local authority areas set out in Table 12-9 and Yorkshire and The Humber consisting of the local authority areas set out in Table 12-12 likely to be suitable to accept waste arisings generated by the project. These three regions have been selected as the project crosses these areas.

12.3.6 The project comprises nine individual schemes that will be delivered in four packages, at different times and across a large geographic area. Each scheme will have a cut/fill balance resulting in materials and waste generation. The cut and fill assessment will be at package, scheme and routewide levels. The full EIA will be at routewide and scheme level, the latter of which being in accordance with *DMRB LA 110*. The design will seek to achieve a balance of cut and fill at an individual scheme, package and project level, taking into account the complexity of the phasing of delivery.

12.4 Overview of consultation to date

12.4.1 Table 12-1 identifies the key comments that have been received to date from external consultees on the scope and approach to the material assets and waste assessment.

Table 12-1: Material assets and waste scope comments to date

Respondent	Comment	How addressed /to be addressed
Environment Agency	We would advise contact with the Environment Agency as early as possible to ensure that any permit or exemption requirements are identified.	Noted.
	Use of the Definition of Waste Code of Practice is recommended throughout the project and should be in place prior to commencement of each stage of works.	This will be included in the Environmental Management Plan (EMP) and Site Waste Management Plan (SWMP).
	For any waste taken off site or brought onto site, the Duty of Care Regulations must be complied with through the use of registered waste carriers and appropriately permitted sites.	This will be included in the EMP and SWMP.
Durham County Council (DCC)	The long term requirement to increase the supplies of Crushed Rock and Sand and Gravel supplies in Durham and the North East.	To be included in the Preliminary Environmental Information (PEI) Report. The new aggregate reserves data will be included in the

Respondent	Comment	How addressed /to be addressed
		Environmental Impact Assessment (EIA) that is presented in the Environmental Statement (ES).
	DCC have established a Mineral Safeguarding Area (MSA) for carboniferous limestone, around the A66 near Bowes which includes two existing quarries and there are also proposals to extend Hulands Quarry to the east.	To be included in the PEI Report. The MSA will be assessed in the ES.
	DCC have identified a number of restoration sites importing inert materials including Kilmond Wood Quarry (192,000m^3) which is situated on the A66, Low Harperley Quarry at Wolsingham (180,000 m^3) and Birtley Quarry (270,000 m3).	Investigation will be made by the project team to identify the feasibility of using excess materials from the A66 in the restoration of sites.
Cumbria County Council (CCC)	The long-term requirement to increase the supplies of Sand and Gravel supplies in Cumbria.	To be included in the PEI Report. The new aggregate reserves data will be included in the ES.
	CCC identified there are no areas of peat suitable for commercial peat extraction within 2km of the current line of the A66. The BGS record various pockets of peat within the 2km corridor: • High Moss (approx. GR NY563296) • Middlebank End Farm (NY715179) • Sandford Mire (NY727170) There is also peat recorded either side of the A66 to the east of South Stainmore (Pennine blanket bog).	To be included in the PEI Report. The sterilisation of peat resources will be assessed in the ES as per *DMRB LA 110*.

12.5 Baseline conditions

Existing baseline

12.5.1 In relation to baseline data, *DMRB LA 110* requires the project to describe the current and future state of study area 1 for the following:

- The types of materials use associated with the operation of the existing road.

- The types and quantities of waste produced associated with the operation of the existing road.
- Information on the availability of key construction materials required for the project.

12.5.2 Information relating to the types of materials consumed and waste generated by the existing road will be presented in the ES. The materials consumed by the existing road will be associated with routine maintenance of the highway, highway infrastructure and road-side technology, such as surfacing asphalt, replacement fencing and barriers and replacement electronic equipment. Waste arisings from operation of the existing road may include waste asphalt from re-surfacing activities, verge clearance waste and Waste Electrical and Electronic Equipment (WEEE) from replacing lighting and other equipment.

12.5.3 In addition *DMRB LA 110* requires the project to describe the current and future state of study area 2 for the following:

- The regional presence and capacity of landfill facilities to be utilised by the project.
- The regional presence and capacity of material recovery / recycling facilities to be utilised by the project.
- The location of mineral sites and peat resources in relation to the project.

Material assets

12.5.4 Material assets used during construction will include primary raw materials such as aggregates and minerals, and manufactured construction products which include recycled and secondary aggregates. The term 'aggregate' is an umbrella descriptor for bulk raw materials used in large development and infrastructure construction projects. These materials can be further defined as primary, secondary or recycled aggregate as follows:

- Primary aggregate - produced from naturally occurring mineral deposits and used for the first time.
- Secondary aggregate – derived from a very wide range of materials that may be used as aggregates.
- Recycled aggregate - can be sourced from a variety of materials arising from construction and demolition (concrete, bricks, and tiles), highway maintenance (asphalt planings), excavation and utility operations.

12.5.5 Most of the material resources required for construction of the project, such as metals, aggregate, pavement, concrete and soils, would originate offsite purchased as construction products. Some, such as excavated soils, would originate onsite. The project will seek to utilise as much soil sourced from within study area 1 (the indicative DCO boundary) as possible. It is considered that minimal bulk materials would be required for operation.The project will consume large quantities of materials increasing demand on the existing UK supply chain. The data of key material products used by the project will be identified in the ES.

12.5.6 The *Local Aggregates Assessments* (LAA) for CDCC (County Durham County Council, 2018a)[171], CCC (Cumbria County Council, 2018)[172] and NYCC (North

[171] County Durham County Council (2018a), Joint Local Aggregates Assessment for County Durham, Northumberland and Tyne and Wear, December 2018 (updated with 2017 sales and reserves data) available from http://durhamcc-consult.limehouse.co.uk/portal/planning/cdpev/
[172] Cumbria County Council (2018) Local Aggregates Assessment, available at: https://www.cumbria.gov.uk/elibrary/Content/Internet/538/755/1929/4343217368.pdf

Yorkshire County Council, 2018a)[173] provide the reserves of material within each area, as summarised in Table 12-2.

Table 12-2: Aggregate reserves within study area 2

Council area	Resource	Reserves (tonnes)	Annual requirement (tonnes)
CDCC	Crushed rock	131,000,000	2,800,000
	Sand and Gravel	8,000,000	300,000
CCC	Crushed rock	127,000,000	2,750,000
	Sand and Gravel (land won)	7,390,000	800,000
NYCC	Crushed rock	88,600,000	3,300,000
	Sand and Gravel	20,4000,000	1,700,000

12.5.7 The CCC *Minerals and Waste Local Plan 2015-2030* (Cumbria County Council, 2017)[174] shows that there are several MSAs for sands and gravel extraction in the vicinity of and crossing the A66 as shown in Figure 12-1. There is also an MSA for gypsum deposits in the Long Marton/Kirkby Thore area where British Gypsum operates an existing mine and plasterboard factory. CDCC has established an MSA for carboniferous limestone around the A66 near Bowes which includes two existing quarries: Hulands Quarry operated by Aggregate Industries and Kilmond Wood Quarry operated by Kearton Farms Ltd. There are also proposals for the working of carboniferous limestone from land to the east of Hulands Quarry. The carboniferous limestone MSA follows the A66 from east of Bowes to Lane Head. CDCC has also identified an MSA for both glacial and river sands and gravel close to the A66. However there are no working sites in the area.

12.5.8 NYCC has a limestone and sand and gravel MSA established at the eastern extent of the project, around Scotch Corner near Darlington.

[173] North Yorkshire County Council (2018a) Local Aggregate Assessment for the North Yorkshire Sub-region Third Review 2017
[174] Cumbria County Council (2017) Cumbria Minerals and Waste Local Plan 2015 to 2030, available at: https://cumbria.gov.uk/elibrary/Content/Internet/538/755/1929/4298491253.PDF

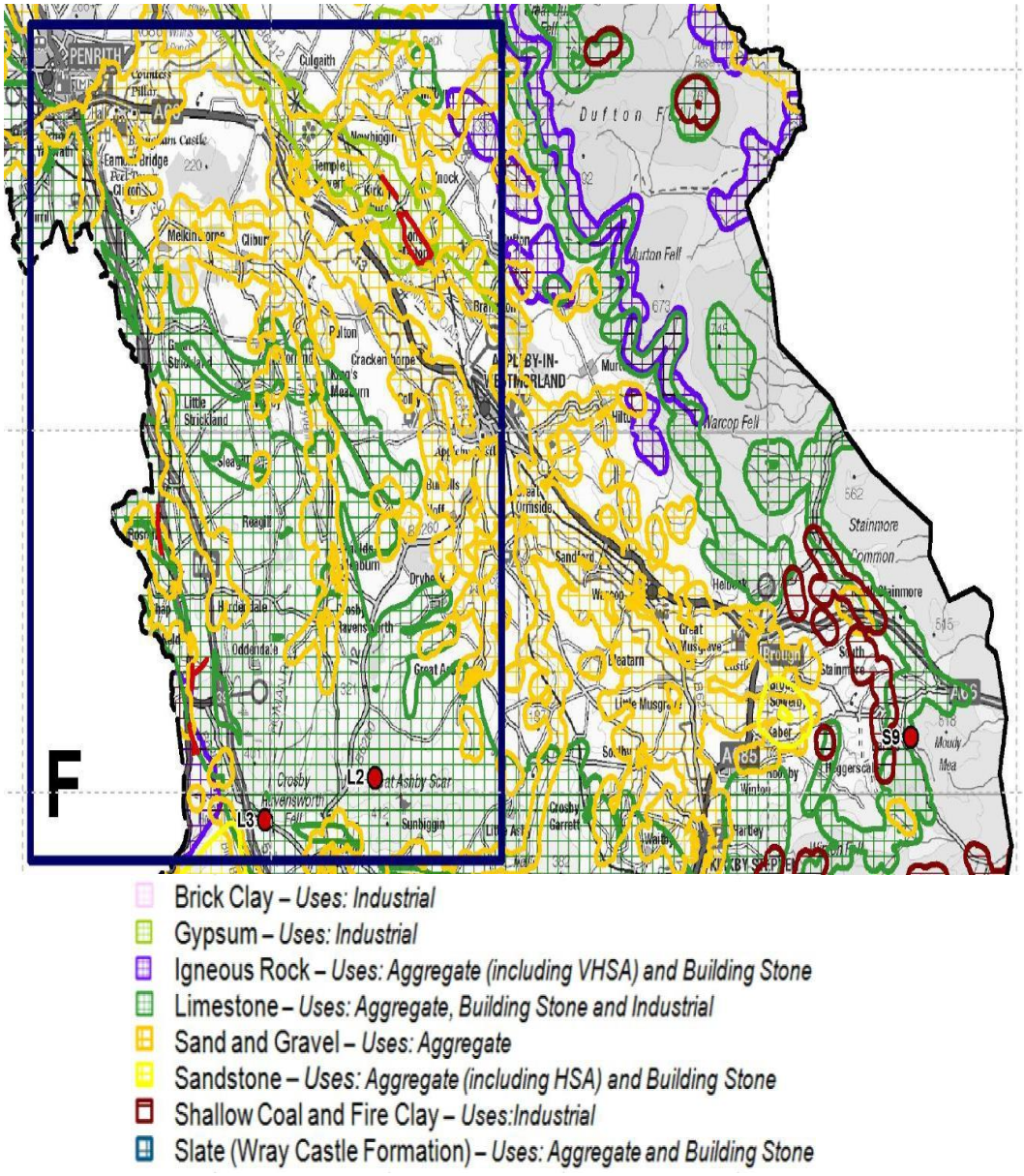


Figure 12-1: Mineral safeguarded areas within CCC (CCC Minerals and waste local plan, Policy map part 2 – Mineral safeguarding areas, 2016

12.5.9 The potential impacts of the sterilisation of existing or future peat resources for commercial extraction will be assessed in the material assets and waste chapter in the ES in line with *DMRB LA 110*. There are no known existing commercial peat extraction sites within study area 1. The extent of peat within study area 1 will be identified in the geology and soils assessment (see Chapter 10: Geology and Soils) using desk-based information supplemented by intrusive ground investigations along the route. The greenhouse gas (GHG) emissions associated with the removal of peat will be identified in the climate assessment (see Chapter 8: Climate).

12.5.10 The *DMRB LA 110* regional recycled aggregate targets provided in Table 12-3 will be used in the EIA process. Where a project is located in more than one region, the highest regional target is adopted (in this case a target of 31% recycled content, reflecting the target set by the Yorkshire and The Humber region). There is a total

aggregate provision of 193 million tonnes in the North East, 392 million tonnes in the North West and 431 million tonnes in Yorkshire and The Humber.

Table 12-3: Highways England *DMRB LA 110* recycled aggregate targets for England 2005 - 2020

Region	Recycled content target	Total aggregate provision (million tonnes)
South East	26%	502
London	48%	197
East	31%	382
East Midlands	14%	784
West Midlands	27%	370
South West	22%	656
North West	30%	392
Yorkshire and The Humber	31%	431
North East	26%	193
England Average	25%	3,908

12.5.11 The targets outlined in Table 12-4 relate to the period from 2005 to 2020. Therefore if these targets were updated by Highways England, as a result of the expiry of their validity period, the project may be required to increase the recycled content target accordingly.

Construction, Demolition and Excavation (CD&E) waste arisings

12.5.12 The project would result in the production of waste arising from Construction, Demolition and Excavation (CD&E) activities. The project will generate large quantities of CD&E waste increasing the demand on the existing waste infrastructure. The data on CD&E waste generated by the project will be identified and assessed in the ES.

12.5.13 The UK had a commitment to recovering (e.g. diverting from disposal) at least 70% of non-hazardous construction waste by 2020 as required by the EU Directive on Waste (European Commission, 2008)[175]. The project will exceed this target as *DMRB LA 110* identifies the project will aim to achieve at least 90% recovery of non-hazardous construction waste. The last published data from 2016 indicated that the England was achieving a recovery rate of 92.1% (Department for Environment, Food & Rural Affairs, 2020)[176].

Waste capacity

12.5.14 Information from the Environment Agency has been used to inform the baseline with respect to waste infrastructure capacity in the North East, North West, and Yorkshire

[175] European Commission (2008) EU Waste Framework Directive
[176] Department for Environment, Food & Rural Affairs (2020) UK Statistics on Waste, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918270/UK_Statistics_on_Waste_statistical_notice_March_2020_accessible_FINAL_updated_size_12.pdf

and The Humber (Environment Agency, 2020)[177]. The Environment Agency provides landfill capacity data in volume (cubic metres) and has therefore been converted to mass (tonnes) using the following conversion factors identified in the *High Speed Rail (2015) Environmental Statement (ES)* (High Speed Rail, 2015)[178]:

- 1.5 tonnes per cubic metre for hazardous waste landfill
- 0.83 tonnes per cubic metre for non-hazardous waste landfill
- 1.5 tonnes per cubic metre for inert waste landfill

12.5.15 These conversion factors were originally derived from Environment Agency data and are considered to be the most up to date and robust conversion factors available for use in the assessment.

12.5.16 Table 12-4 below provides a summary of the transfer, treatment and metal recycling capacity within the North East in 2019 (Environment Agency, 2019)[179]. The data identifies there was adequate transfer, treatment and metal recycling infrastructure in the North East in 2019.

Table 12-4: Transfer, treatment and metal recycling site input for the North East in 2019

Facility type	County Durham (tonnes)	Northumberland (tonnes)	Tees Valley Unitary (tonnes)	Tyne and Wear (tonnes)	North East Capacity (tonnes)
Waste transfer	410,000	456,000	570,000	1,308,000	2,744,000
Waste treatment	337,000	368,000	2,079,000	963,000	3,747,000
Metal recycling	56,000	4,000	386,000	254,000	700,000
Total treatment and waste transfer	803,000	828,000	3,035,000	2,525,000	7,191,000

12.5.17 Table 12-5 below provides a summary of the landfill capacity in the North East in 2019 (Environment Agency, 2017)[180]. The data identifies there was adequate landfill capacity in the North East in 2019.

[177] Environment Agency (2020) Mapping, available at: http://apps.environment-agency.gov.uk/wiyby/default.aspx
[178] High Speed Rail (London – West Midlands) (2015) Supplementary Environmental Statement 3 and Additional Provision 4 Environmental Statement Volume 5 Technical appendices Waste and material resources, available at:
[179] Environment Agency (2019) Waste Management Information 2018 Former North East Planning Region
[180] Environment Agency (2017) Remaining Landfill Capacity. Retrieved from https://data.gov.uk/dataset/remaining-landfill-capacity

Table 12-5: Landfill capacity in the North East in 2019

Facility type	County Durham (tonnes)	Northumberland (tonnes)	Tees Valley Unitary (tonnes)	Tyne and Wear (tonnes)	North East Capacity (tonnes)
Inert waste landfill	12,028,500	238,500	0	1,804,500	14,071,500
Non-hazardous landfill	2,948,990	918,810	3,012,900	495,510	7,376,210
Hazardous landfill	0	0	10,278,000	0	10,278,000

12.5.18 Table 12-6 below provides a summary of the transfer, treatment and metal recycling capacity in the North West in 2019 (Environment Agency, 2019)[181]. The data identifies there was adequate transfer, treatment and metal recycling infrastructure capacity in the North West in 2019.

Table 12-6: Transfer, treatment and metal recycling site input in the North West in 2019

Facility type	Cheshire (tonnes)	Cumbria (tonnes)	Greater Manchester (tonnes)	Lancashire (tonnes)	Merseyside (tonnes)	North West (tonnes)
Waste transfer	423,000	395,000	2,301,000	1,196,000	1,870,000	6,185,000
Waste treatment	1,880,000	1,161,000	7,210,000	3,090,000	4,172,000	17,513,000
Metal recycling	50,000	50,000	709,000	243,000	1,708,000	2,760,000
Total treatment and waste transfer	2,353,000	1,606,000	10,220,000	4,529,000	7,750,000	26,458,000

[181] Environment Agency (2019) Waste Management Information 2018 Former North East Planning Region

12.5.19 Table 12-7 below provides a summary of the landfill capacity in the North West in 2019 (Environment Agency, 2019)[182]. The data identifies there was adequate landfill capacity in the North West in 2019.

Table 12-7: Landfill capacity North West in 2019

Facility type	Cheshire (tonnes)	Cumbria (tonnes)	Greater Manchester (tonnes)	Lancashire (tonnes)	Merseyside (tonnes)	North West (tonnes)
Inert waste landfill	1,140,000	1,576,500	2,088,000	2,670,000	771,000	8,245,500
Non-hazardous landfill	6,325,430	2,548,930	4,795,740	6,795,210	0	20,465,310
Hazardous landfill	6,433,500	0	0	2,791,500	0	9,225,000

12.5.20 Table 12-8 below provides a summary of the transfer, treatment and metal recycling infrastructure capacity in Yorkshire and The Humber in 2019 (Environment Agency, 2019)[183]. The data identifies there was adequate transfer, treatment and metal recycling infrastructure capacity in Yorkshire and The Humber in 2019.

Table 12-8: Transfer, treatment and metal recycling site input Yorkshire and The Humber in 2019

Facility type	Former Humberside (tonnes)	North Yorkshire (tonnes)	South Yorkshire (tonnes)	West Yorkshire (tonnes)	Yorkshire & The Humber (tonnes)
Waste transfer	1,602,000	548,000	1,620,000	1,319,000	5,089,000
Waste treatment	3,628,000	940,000	2,188,000	5,114,000	11,870,000
Metal recycling	514,000	53,000	786,000	439,000	1,792,000
Total treatment and	5,744,000	1,541,000	4,594,000	6,872,000	18,751,000

[182] Environment Agency (2019) Waste Management Information 2019 Former North East Planning Region
[183] Environment Agency (2019a) Waste Management Information 2019 Former Yorkshire and The Humber Planning

Facility type	Former Humberside (tonnes)	North Yorkshire (tonnes)	South Yorkshire (tonnes)	West Yorkshire (tonnes)	Yorkshire & The Humber (tonnes)
waste transfer					

12.5.21 Table 12-9 below provides a summary of the landfill capacity within Yorkshire and The Humber in 2019 (Environment Agency, 2019)[184]. The data identifies there was adequate landfill capacity within Yorkshire and The Humber in 2019.

Table 12-9: Landfill capacity in Yorkshire and The Humber in 2019

Facility type	Former Humberside (tonnes)	North Yorkshire (tonnes)	South Yorkshire (tonnes)	West Yorkshire (tonnes)	Yorkshire & The Humber (tonnes)
Inert waste landfill	23,010,000	1,887,000	8,616,000	4,696,500	38,209,500
Non-hazardous landfill	20,334,170	14,193,830	1,423,450	1,039,160	36,990,610
Hazardous landfill	1,252,500	0	0	2,722,500	3,975,000

12.5.22 A non-exhaustive list of permitted landfill sites that could potentially accept CD&E waste generated during the construction phase of the project can be seen in Table 12-10 (Environment Agency, 2018)[185].

Table 12-10: Non-exhaustive list of landfill sites that could potentially accept CD&E waste arisings

Facility Name	Facility Type*	Permit Number	Post code	Remaining capacity (tonnes)
Augean North Limited Approximate distance: 33km	L01 - Hazardous Merchant Landfill	BV1399IT	TS2 1UE	7,406,880
Whitemoss Landfill Ltd Approximate distance: 146km	L01 - Hazardous Merchant Landfill	DP3639LM	WN8 8BW	2,230,500
Bostock Landfill Approximate distance: 185km	L01 - Hazardous Merchant Landfill	AP3238GH	CW10 9JQ	2,230,500

[184] Environment Agency (2019a) Waste Management Information 2019 Former Yorkshire and The Humber Planning
[185] Environment Agency (2018) Remaining Landfill Capacity. Retrieved from https://data.gov.uk/dataset/remaining-landfill-capacity.

Facility Name	Facility Type*	Permit Number	Post code	Remaining capacity (tonnes)
Flusco Pike Landfill Approximate distance: 5km	L02 Non-hazardous stable non-reactive waste (SNRHW) landfill	EA/EPR/FP3393ZK/V002	CA11 0JA	733,721
Aycliffe Quarry East Approximate distance: 23km	L02 Non-hazardous stable non-reactive waste (SNRHW) landfill	EA/EPR/BP3890ZK/A001	DL5 6NB	1,563,223
Lillyhall Landfill Stage 3 Approximate distance: 63km	L02 Non-hazardous stable non-reactive waste (SNRHW) landfill	EA/EPR/EP3693ZZ/A001	CA14 4JP	739,563
Allerton Park Approximate distance: 51km	L04 Non-hazardous	EA/EPR/SP3390ZE/A001	HG5 0SD	1,794,022
Hespin Wood Approximate distance: 51km	L04 Non-hazardous	EA/EPR/HP3193ZX/S011	CA6 4HB	1,036,545
Harewood Whin Landfill Approximate distance: 69km	L04 Non-hazardous	EA/EPR/CB3430DW/A001	YO23 3RR	498,000
Bennet Bank Landfill Approximate distance: 80km	L04 Non-hazardous	EA/EPR/XP3993ZN/V002	LA14 4QH	109,958
Bishop Middleham Quarry 2 Approximate distance: 35km	L05 Inert	EA/EPR/RP3496ZM/A001	DL17 9EB	6,473,339
Old Quarrington Quarry Landfill Approximate distance: 39km	L05 Inert	EA/EPR/BB3007CA/V005	DH6 5NN	2,291,871
Asenby Quarry Ltd Approximate distance: 43km	L05 Inert	EA/EPR/QP3139XR/A001	YO7 3RB	486,239

Facility Name	Facility Type*	Permit Number	Post code	Remaining capacity (tonnes)
Crime Rigg Quarry Landfill Approximate distance: 44km	L05 Inert	EA/EPR/FB3602TW/T001	DH6 1LA	2,670,000
Roan Edge Landfill Approximate distance: 44km	L05 Inert	EA/EPR/MP3034SJ	LA10 5EW	272,150
Goldmire Quarry Approximate distance: 101km	L05 Inert	EA/EPR/CB3705TJ/V002	LA15 8BG	1,265,621
Wilberfoss Quarry Landfill Approximate distance: 107km	L05 Inert	EA/EPR/VP3634LC/A001	YO41 4DB	878,106

Future baseline

12.5.23 The future baseline data for material assets and waste are presented below. The future baseline data for materials assets and waste will be updated in the ES.

Material assets

12.5.24 A breakdown of the key material resources likely to be used during construction of the project along with the percentage change in sales volumes within the UK (Mineral Products Industry, 2018)[186], are displayed in Figure 12-2. In 2018 the UK sales figures increased for crushed rock (5%), sand and gravel (1%), asphalt (5%), ready-mixed concrete (2%), and mortar (8%). The project will consume large quantities of these key materials increasing the demand on the existing UK supply chain. The data on key material products used by the project will be identified in the ES.

[186] Mineral Products Industry (2018) The mineral products industry key facts at a glance, available at: https://mineralproducts.org/documents/Mineral_Products_Industry_at_a_Glance.pdf

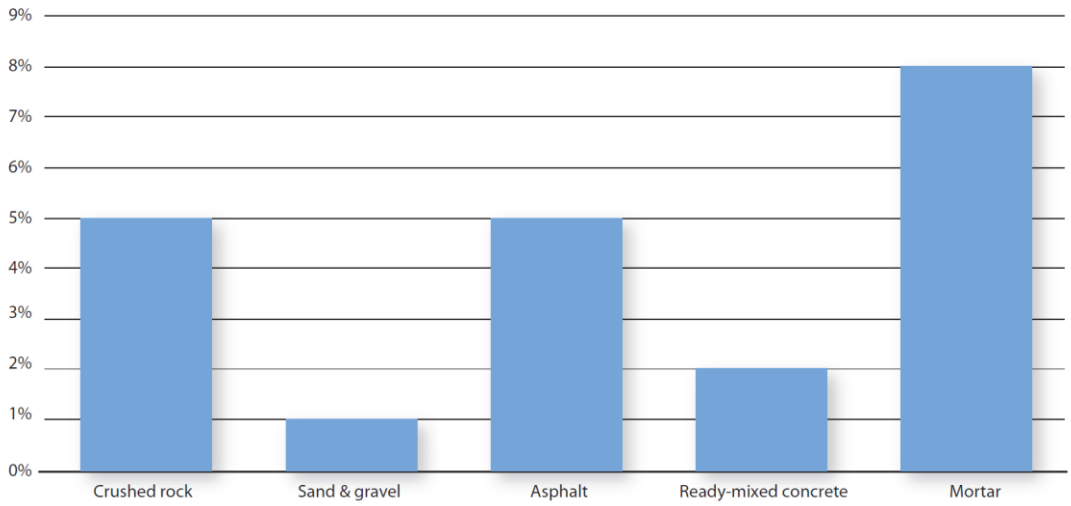


Figure 12-2: Medium Term Outlook for aggregates 2018 to 2020 (reproduced from the Mineral Product Association's Profile of the UK Mineral Products Industry, 2018 Edition

Waste

12.5.25 The CDCC (Durham County Council, 2019)[187], CCC (Cumbria County Council, 2017)[188], and NYCC (North Yorkshire County Council, 2018b)[189] *Local Plans* present the future expected waste arisings. Table 12-11 below provides a summary of the projected CD&E waste arisings within CDCC, CCC, and NYCC.

Table 12-11: Projected CD&E waste arisings

Sub-region	Projected CD&E Annual Waste Arisings (tonnes)		
	2020	2025	2030
CDCC	623,300	623,300	623,300
CCC	940,833	1,176,275	1,070,626
NYCC	871,196	897,639	920,306
Total	2,435,329	2,697,214	2,614,232

12.6 Potential impacts

Construction

Material assets

12.6.1 With respect to material resources, the project's environmental impacts relate to the extraction of primary raw materials and the production of construction materials. In addition the project has the potential to constrain existing or future use and extraction of materials.

12.6.2 A summary of the impacts , as identified in *DMRB LA 110*, included in the assessment are summarised below:

- The sterilisation of mineral safeguarding sites and/or peat resources.
- The consumption of virgin materials.

Waste

12.6.3 In terms of waste, potential environmental impacts are primarily related to the production, movement, transport, processing and disposal of waste from the project.

12.6.4 The project has the potential to generate large amounts of CD&E waste which may affect the capacity of waste management infrastructure in study area 2 (the North East, the North West and Yorkshire and The Humber regions).

12.6.5 Potential impacts could include the temporary occupation of waste management capacity (during treatment) and a permanent decrease in landfill capacity (disposal).

[187] Durham County Council (2019) County Durham Plan – Local Development Scheme, available at: https://www.durham.gov.uk/media/22975/County-Durham-Local-Development-Scheme-2019/pdf/CountyDurhamLDSJune_2019C5.pdf?m=637060366655830000http://maps.durham.gov.uk/localplan/default.aspx
[188] Cumbria County Council (2017) Cumbria Minerals and Waste Local Plan 2015 – 2030, available at: https://cumbria.gov.uk/elibrary/Content/Internet/538/755/1929/4298491253.PDF
[189] North Yorkshire County Council (2018b) Minerals and Waste Joint Plan of North Yorkshire County Council, the City of York Council and the North York Moors National Park Authority (PUBLICATION DRAFT).

12.6.6 Although much of the area surrounding the existing A66 is undeveloped land, there are buildings and existing infrastructure (e.g. services, roads, drains) which would need to be demolished prior to construction.

12.6.7 As this is a large-scale project, the quantities of waste and material resources associated with the earthworks mean that a balance between excavation (cut) and material placement (fill) may not be achieved. If there is more cut material than is required for fill, the material would be removed for re-use offsite. Therefore onsite generated material resources and waste arisings may have an effect on the existing landfill capacity.

12.6.8 The potential waste types that could arise during the construction phase are summarised in Table 12-12.

Table 12-12: Potential waste sources during the construction phase

Construction phase	Potential wastes produced	Classification of waste	Potential impacts
Construction	Construction materials, such as concrete, bricks, plastics, metals, plasterboard, timber, paint, etc.	Inert; and / or, Non-hazardous; and / or, Hazardous.	The reduction in regional inert, non-hazardous and hazardous landfill capacity. The reduction in national landfill capacity.
	Made ground, soil and sub-soils.	Non-hazardous, and Hazardous if it contains sufficiently high levels of heavy metals.	The reduction in regional non-hazardous and hazardous landfill capacity. The reduction in national landfill capacity.
	Waste products arising from the presence of construction staff onsite. e.g. effluent from portable toilets, food waste and packaging, as well as waste from surplus materials and spillages.	Inert; Non-hazardous and potentially Hazardous.	The reduction in regional inert, non-hazardous and hazardous landfill capacity. The reduction in national landfill capacity.
Demolition	Building materials, such as concrete, bricks, plastics, metals, plasterboard, timber, paint, etc. Made ground, soil and sub-soils Asphalt and	Inert; and / or, Non-hazardous; and / or, Hazardous. Non-hazardous, and Hazardous if it contains sufficiently high levels of heavy	The reduction in regional inert, non-hazardous and hazardous landfill capacity. The reduction in national landfill capacity.

Construction phase	Potential wastes produced	Classification of waste	Potential impacts
	bituminous products.	metals or if asphalt contains coal tar.	
Excavation	Made ground, soil and sub-soils.	Inert; and / or, Non-hazardous; and / or, potentially Hazardous if it contains sufficiently high levels of heavy metals.	The reduction in regional inert, non-hazardous and hazardous landfill capacity. The reduction in national landfill capacity.

12.6.9 A summary of the potential impacts for waste identified in *DMRB LA 110* are summarised below:

- The reduction in regional landfill capacity.
- The reduction in national landfill capacity.

Operation

12.6.10 Table 12-13 below summarises the types of waste arisings that may potentially be generated during the first year of operation of the project. The operational waste streams generated by the project are likely to be similar to the wastes generated from the existing A66. Therefore, operational waste generated by the project is not likely to be difficult to manage or dispose.

Table 12-13: Potential waste arisings during the first year of operation

Project Activity	Activities generating waste	Classification of waste	Potential Impacts
Operation and maintenance	Routine maintenance of infrastructure and technology, including surfacing asphalt and servicing of electronic equipment.	Waste arisings during the operational phase are expected to be minimal however there is likely to be hazardous waste such Waste Electrical and Electronic Equipment (WEEE) from replacing lighting and other equipment. Also, non-hazardous waste will arise from re-surfacing and other activities.	Operational waste generated by the project is not likely to result in any potential impacts.

12.7 Design, mitigation and enhancement measures

12.7.1 The design of the project is ongoing along with the development of mitigation measures relating to material assets and waste. However the initial measures have been developed using a series of principles to drive the mitigation of materials use and waste generation, treatment and disposal. These measures will be explored in more detail during the EIA process in consultation with the project team and the Preferred Construction Contractor (PCC) for each scheme/package when appointed,

to introduce good practice sustainable resource and waste management from an early stage of the project.

Design

12.7.2 By considering materials at the earliest opportunity in the design process there are likely to be far more significant opportunities for resource efficiency. *DMRB LA 110* Section 3.18 identifies that the ES shall include evidence of the adoption of design and mitigation measures (Designing out Waste) for material assets including:

- *"Design for re-use and recovery: identifying, securing and using materials that already exist onsite or can be sourced from other projects.*
- *Design for materials optimisation: simplifying layout and form to minimise material use, using standard design parameters, balancing cut and fill, maximising the use of renewable materials and materials with recycled content.*
- *Design for offsite construction: maximising the use of prefabricated structure and components, encouraging a process of assembly rather than construction.*
- *Design for the future (deconstruction and flexibility): identify how materials can be designed to be more easily adapted over an asset lifetime and how de-constructability and de-mountability of elements can be maximised at end of first life.*
- *Design for waste efficient procurement: identify and specify materials that can be acquired responsibly, in accordance with recognised industry standards.*
- *Engineering plan configurations and layouts that show how the most effective use of materials and arisings can be achieved."*

12.7.3 The project team will investigate the potential for offsite construction of certain elements of the project. Offsite construction can drive improvements in the products or processes employed in construction, ranging from innovative products such as asphalt surfaces on a 'carpet roll' to be used onsite through to precast components manufactured offsite.

12.7.4 The project team will also investigate the opportunity to introduce the standardisation of selected materials to ensure waste inherent in the design is reduced. Standardisation can be applied to pre-cast concrete components such as pavers, kerbs, and blocks, and drainage such as gullies, pipes and chambers.

Mitigation

Material assets

12.7.5 The depletion of finite material resources will occur through extraction of primary aggregates (e.g. sands and gravels). Structures, drainage and signage products will be procured with consideration of the environmental impacts associated with their manufacture, as well as other considerations such as structural design, carbon footprint (PAS 2050), energy consumption, long-life performance, visual impacts, durability and cost.

12.7.6 Site levels and grading of the project will be designed to achieve a cut and fill balance where practicable in order to minimise excavation quantities. The project will also be designed to enable flexibility in the landscaping, so that it can accommodate changes in excavation volumes that may arise when site conditions differ from those assumed during the design.

12.7.7 The earthworks strategy will enable materials excavated onsite to be re-used at areas of the site where materials are required as far as practicable. This will minimise the

amount of material required from offsite. In addition it may also be possible to identify other construction projects located in study area 2 that can re-use the materials. The earthworks strategy will, however, be influenced by the approach to construction phasing and there may be limitations on how materials can be re-used between schemes. The earthworks strategy will be included as a reference source in the ES.

12.7.8 It is also possible to consider the environmental credentials of materials such as the Waste & Resources Action Plan Quality Protocols.

Waste

12.7.9 The project design will take into consideration the waste hierarchy as required by *DMRB LA 110* (see Figure 12-3) with a view to minimising the overall volume of waste arisings via designing out waste and maximising efficient use of materials, ultimately to prevent and minimise waste sent to landfill.

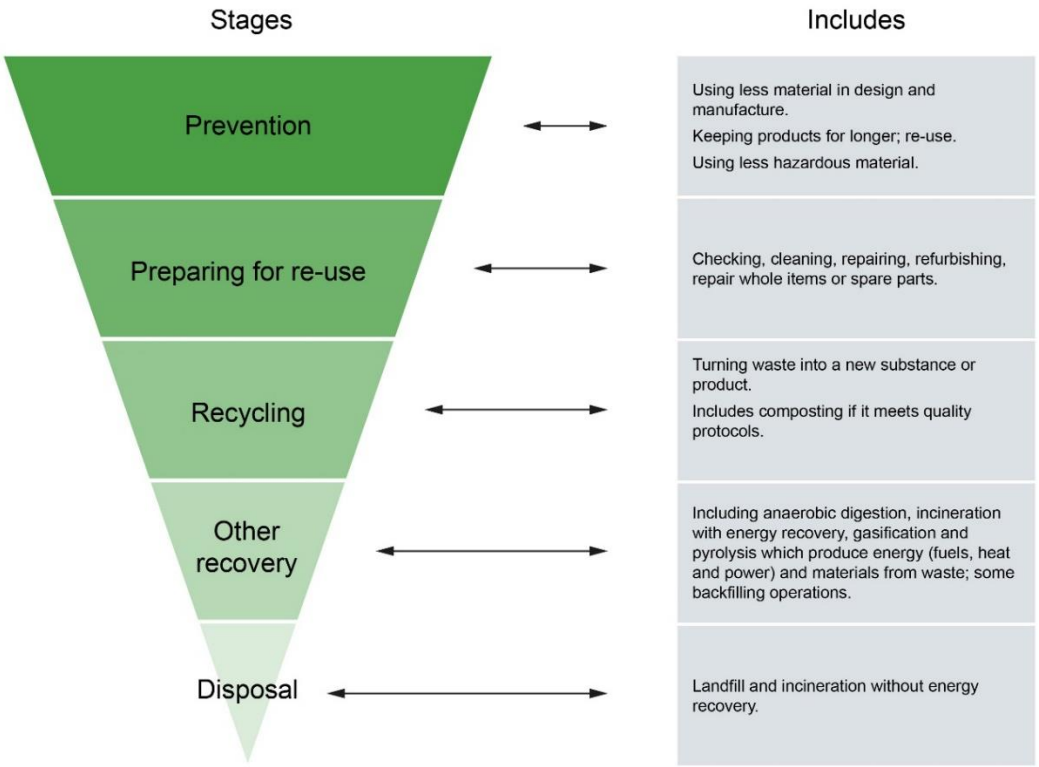


Figure 12-3: The Waste Hierarchy

12.7.10 The project will generate material from demolition and the project team will investigate how demolition materials can be integrated with a future works programme, or be considered for use in other construction projects, to minimise their classification as waste as far as practicable. The project will consider the *Demolition Protocol* (Institute of Civil Engineers, 2008)[190], a resource efficiency model that shows how the production of demolition material can be linked to its specification as a high-value material both onsite and in other construction projects. The project team will investigate the opportunities to re-use existing foundations, structures, pavements, floor slabs and services onsite. Where this is not appropriate the PCC will consider

[190] Institute of Civil Engineers (2008) Demolition Protocol

crushing demolition materials for recycling as aggregates onsite. If onsite recycling is not feasible the PCC will identify opportunities for recycling the demolition materials offsite in any Highways England or other suitable local projects, through a recycling contractor or in other external projects.

12.7.11 In addition to these embedded mitigation measures, other materials and waste measures that will be considered as part of the EIA process include:

- Specifying the use of materials with a high percentage of recycled content.
- Local sources for aggregate supplies should be considered whenever possible.
- Re-using packaging by returning to supplier/manufacturer or using it for other purposes (e.g. timber packaging pallets can be chipped and used for landscaping top mulch).

12.7.12 Other relevant good practice controls during the construction phase (for example segregated materials storage and re-use of inert materials for grading) are likely to be included as requirements within the MMP and SWMP which would form part of the EMP prepared as part of the EIA.

12.7.13 While reduction of waste should remain the highest priority, where feasible waste produced shall be segregated for recycling. This will allow materials to be recycled and ultimately reduce the amount of waste that has to be finally disposed of. Each PCC will establish waste storage and recycling areas, for each scheme or package, for the safe storage and processing of recovered materials to ensure that opportunities for re-use are maximised. Where no other waste management option is found to be feasible, wastes shall be sent to an appropriately permitted landfill site in accordance with UK legislation and any Highways England requirements.

12.7.14 For any waste taken off site or brought onto site, the Duty of Care Regulations must be complied with through the use of registered waste carriers and appropriately permitted sites.

12.7.15 Hazardous waste shall be correctly labelled and should not be mixed with non-hazardous waste. It should be securely contained and disposed of at an appropriately permitted facility via a registered waste carrier.

12.7.16 Onsite investigation is also required to determine the levels of contaminated land, identify the appropriate remediation options and agree the preferred approach with the regulatory authorities. Any contaminated excavated material will have to be carefully segregated and stored to minimise cross contamination of clean materials.

Environmental Management Plan

12.7.17 The EMP for the project will include materials and waste information and will incorporate an outline SWMP. The EMP will capture information and data on site arisings recovered/diverted from landfill and waste and specify management requirements for construction materials, site arisings and waste. The EMP will be reviewed and monitored to meet the requirements of Section 4 of *DMRB LA 110*.

Materials Management Plan

12.7.18 The outline MMP will be prepared pre-construction following the protocols within the Contaminated Land: Applications in Real Environments (CL:AIRE) Definition of Waste (Contaminated Land: Applications in Real Environments, 2011)[191].

Site Waste Management Plan

12.7.19 A SWMP is used to plan, implement, monitor and review waste minimisation and management on construction sites. The SWMP is also used to record how waste is prevented, minimised, re-used, recycled and disposed of on a construction site. The SWMP will be a live document, reviewed and updated regularly during the course of the project.

12.8 Description of the Likely Significant Effects

12.8.1 At this stage of the assessment the potential significant effects have been identified from Tables 3.13 and 3.14 in *DMRB LA 110* for material assets and waste. Whilst mitigation is a key focus there remains the potential for residual effects. The likely effects listed below represent a significant effect in *DMRB LA 110*.

Construction

Material assets

- The sterilisation of 1> mineral safeguarding site and/or peat resources.
- Aggregates required to be imported to site to comprise re-used/recycled content below the relevant regional percentage target (less than 31%).
- A low recycling and recovery rate (less than 70%) of non-hazardous CDW.

Waste

- Disposal of 1-50% of project waste outside study area 2 (the North East, the North West and Yorkshire & The Humber region).
- >1% reduction or alteration in the capacity of landfill capacity in study area 2 as a result of accommodating waste from the project.

Operation

Material assets

12.8.2 During operation of the project, materials use is expected to be limited. Therefore, only the first year of operation has been scoped into the assessment.

Waste

12.8.3 During operation of the project, waste generation is expected to be limited. Therefore, only the first year of operation has been scoped into the assessment.

12.9 Assessment methodology

12.9.1 An assessment of material assets and waste will be undertaken of the delivery of the project in accordance with *DMRB LA 110* section 1.4 and shall include:

[191] Contaminated Land: Applications in Real Environments (2011) The Definition of Waste: Development Industry Code of Practice, Version 2, Contaminated Land: Applications in Real Environments, available at: http://adeptus.co.uk/definition-waste-development-industry-code- practice-version-2-released/.

- The consumption of materials and products (from primary, recycled or secondary, and renewable sources, the use of materials offering sustainability benefits, and the use of excavated and other arisings that fall within the scope of waste exemption criteria.
- The production and disposal of waste.

12.9.2 These impacts will be assessed in the context of relevant policies, standards and guidance relating to materials and waste management at the project, local, regional and national level.

12.9.3 Effects associated with the transportation of materials (GHG emissions, air quality, noise etc.) are not covered within this methodology and will be addressed in the relevant environmental topics of the ES.

12.9.4 Mitigation measures to reduce the material assets and waste impacts of the project will follow the principles of sustainable resource and waste management in accordance with the waste hierarchy as described in *DMRB LA 110* (see Figure 12-3).

12.9.5 The assessment will consider the impact on the environment as a result of the generation and management of waste and will detail measures to mitigate these impacts:

- Demolition waste – although much of the area surrounding the existing A66 is undeveloped land, there are isolated farm steadings and existing infrastructure (e.g. services, roads, drains) which would need to be removed prior to construction. These are likely to consist of hard and inert materials, soils, rock and stones, wood (including vegetation), asphalt, brick, concrete, miscellaneous metals.
- Construction and excavation waste – waste is likely to arise from the construction and excavation phases which would consist of hard and inert materials, soils and stones, wood, plastics, packaging (wooden and plastic), insulation material, miscellaneous metals, canteen and office waste.

12.9.6 *DMRB LA 110* Section 2.3 identifies that the application of the waste hierarchy (see Figure 12-3) can require specific waste streams to depart from the hierarchy where this:

- “Is justified by lifecycle thinking; and
- Delivers the best overall environmental outcome.”

12.9.7 *DMRB LA 110* requires that the following information on material assets from the delivery of trunk roads projects will be identified:

- Types and quantities of materials required to construct the project.
- Information on materials that contain secondary aggregate / recycled content.
- Information on any known sustainability credentials of materials to be consumed.
- The type and volume of materials that will be recovered from offsite sources for use on the project.
- The cut and fill balance.
- Details of onsite storage and stockpiling arrangements, and any supporting logistical details.

12.9.8 For waste, the assessment will identify the following:

- The amount of waste (by weight) that will be recovered and diverted from landfill either onsite or offsite (i.e. for use on other projects).
- Types and quantities of waste arising from the project (demolition, excavation, construction arisings and remediation) requiring disposal to landfill.

- Details of onsite storage and segregation arrangement for waste and any supporting logistical arrangements.
- Potential for generation of hazardous waste (type and quantity).

12.9.9 Any assumptions and limitations on data gaps will be reported in the ES. To minimise the effects from material assets usage and waste production the assessment will identify the location of sensitive receptors (e.g. designated sites identified in other environmental topics).

12.9.10 Table 3.13 in *DMRB LA 110* describes the significance category descriptions for material assets and waste. The significance of effects on material assets and waste will be reported in accordance with the significance criteria taken from Table 3.14 in *DMRB LA 110*.

Targets and key performance indicators

12.9.11 There are two Highways England materials and waste targets included in *DMRB LA 110* for the project:

- Construction materials will have recycled content target of 31%; and
- At least 70% (by weight) of CDW will be subjected to material recovery in accordance with the Waste Directive.

12.9.12 In addition, the project will aim to achieve at least 90% (by weight) material recovery of non hazardous C&DW.

12.10 Assessment assumptions and limitations

12.10.1 The material resources and waste assessment will be undertaken on the basis of information available at the time of the assessment. It is anticipated that some of the information required for a full detailed assessment may not be known in sufficient time to inform the EIA, such as the exact sources/origins of materials. Any assumptions made for the assessment, their basis, and the limitations this presents will be reported in the ES.

12.10.2 The environmental impacts associated with the extraction of raw materials and the manufacture of products are excluded from the scope of the assessment. These impacts would occur offsite and may possibly occur outside the UK. They include the depletion of non-renewable resources and the production of waste at the point of extraction and during manufacturing.

Table 12-14: Material Assets and Waste scoping criteria from *DMRB LA 110* - construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) is the project likely to recover/reuse little on site material thereby requiring materials to be imported to site?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2) is the project likely to use little/no recycled/secondary materials thereby requiring the majority of materials used on the project to comprise primary materials?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3) the project is likely to sterilise (substantially constrain/prevent existing and potential future use of) mineral sites or peat resources?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4) would the project generate large quantities of waste relative to regional landfill capacity?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5) will the project have an effect on the ability of waste infrastructure within the region to continue to accommodate waste from other sources?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Key mitigation	The design of the proposed scheme is ongoing along with the development of mitigation measures relating to material assets and waste. However, the initial key mitigation has been developed: Specifying the use of materials with a high percentage of recycled content. The proposed scheme aims to achieve that construction materials will have recycled content target of 31%; The project team will investigate how demolition materials can be integrated with a future works programme or at least be considered for use in other construction projects. Site levels and grading of the project would be designed to attain a cut and fill balance where practicable to help minimise excavation quantities. The earthworks strategy will enable materials which will be excavated onsite to be re-used at areas of the site where materials are required. This will minimise the amount of material that is required from offsite. While reduction of waste should remain the highest priority, where feasible waste produced shall be segregated for recycling. This will allow materials to be recycled and ultimately reduce the amount of waste that has to be finally disposed of. The proposed scheme aims to achieve at least 90% (by weight) material recovery of non-hazardous construction and demolition waste									
Proposed Scope (In)	Scope in	Scope in	Scope in	Scope in	Scope in	Scope in	Scope in	Scope in	Scope in	Following a review, all of the above aspects 1-5 of the material assets and waste assessment during construction are currently scoped in. This is based on a worst-case scenario as each of the aspects could potentially produce a significant effect at both scheme or / and at a route wide level. At a later stage in the assessment process, when additional information becomes available it is likely that certain aspects can be

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
										scoped out at a scheme level[192]. The scoping exercise will be repeated during the development of the Preliminary Environmental Information Report (PEIR) and the Environmental Statement (ES).
Proposed Scope (Out)	-	-	-	-	-	-	-	-	-	At this point in the assessment it is not possible to scope out any aspect of the material assets and waste assessment during construction.

Table 12-15: Geology scoping criteria from *DMRB LA 109* - operation

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
1) is the project likely to recover/reuse little on site material thereby requiring materials to be imported to site?	N	N	N	N	N	N	N	N	N	Y
2) is the project likely to use little/no recycled/secondary materials thereby requiring the majority of materials used on the project to comprise primary materials?	N	N	N	N	N	N	N	N	N	Y
3) the project is likely to sterilise (substantially constrain/prevent existing and potential future use of) mineral sites or peat resources?	N	N	N	N	N	N	N	N	N	Y
4) would the project generate large quantities of waste relative to regional landfill capacity?	N	N	N	N	N	N	N	N	N	Y
5) will the project have an effect on the ability of waste infrastructure within the region to continue to accommodate waste from other sources?	N	N	N	N	N	N	N	N	N	Y
Key Mitigation	-	-	-	-	-	-	-	-	-	-

[192] It is not possible to scope out aspect 1 at a scheme or / and at a routewide level until the earthworks estimate becomes available from the project team. It is not currently clear whether this information will be available for the PEIR or whether it will only become accessible for the ES.
It is not possible to scope out aspect 2 at a scheme and/or routewide level until the recycled content estimate is available from the design team. This will either be covered in the Preliminary Environmental Information (PEI) Report if available,or will be presented in the Environmental Statement (ES). In relation to aspect 3, not all schemes are likely to contain Mineral Safeguarding Areas (MSAs) or a peat resource. Therefore, it is unlikely that all the schemes will result in a likely significant effect. However, it is not currently appropriate to scope out any of these schemes until a) the preliminary design is available and b) further consultation has been undertaken with local authorities to confirm the location of MSAs and peat resources.

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Proposed Scope (In)	-	-	-	-	-	-	-	-		Scope in Materials resource use and waste generation during the operational phase and maintenance are expected to be minimal. Therefore, this aspect has been scoped in on a routewide basis for the first year of operation.
Proposed Scope (Out)	Scope out	Scope out	Scope out	Scope out	Scope out	Scope out	Scope out	Scope out		Scope out The materials assets and waste assessment will not consider operational impacts at a scheme level as the resource use and waste generation will be too small.

13 Noise and Vibration

13.1.1 This chapter outlines the proposed scope of assessment to be undertaken for noise and vibration.

13.1.2 There will be interrelationships related to the potential effects on noise and other disciplines. Therefore, please refer to the following chapters:

- Chapter 7: Biodiversity
- Chapter 9: Cultural Heritage
- Chapter 11: Landscape and Visual
- Chapter 14: Population and Human Health

13.1.3 The methodology used will follow the requirements of *DMRB LA 111 Noise and Vibration* (Highways England, 2020)[193]. *DMRB LA 111* provides a methodology that draws together the requirements of law, standards and policy relating to noise and vibration associated with road scheme.

13.2 Key questions for scoping

1. Do you agree with the proposed scope of the noise and vibration assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the noise and vibration assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments?
4. Are there any other key issues or aspects relevant to the noise and vibration that you wish to bring to the attention of the design and assessment team?
5. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

13.3 Study area

13.3.1 This section presents the definition of the study area for the construction noise, construction vibration and operational noise in line with, *DMRB LA 111 Noise and vibration*, hereinafter referred to as '*DMRB LA 111'*

13.3.2 As stated in *DMRB LA 111*, variations in the study area can be defined for individual projects. Professional judgement will be exercised in deciding the extent of the study area.

13.3.3 As part of the assessment it is intended to identify both residential and non-residential sensitive receptors within the study areas using Ordnance Survey address point data (AddressBase Premium/AddressBase Plus) and freely available Geographical Information System (GIS) data sets. These sensitive receptors include: residential dwellings, hospitals, healthcare facilities, education facilities, community facilities, European Noise Directive (END) quiet areas or potential END quiet areas, international or statutorily designated sites, public rights of way and cultural heritage assets.

[193] Highways England (2020) Noise and vibration LA 111, available at: https://www.standardsforhighways.co.uk/dmrb/search/cc8cfcf7-c235-4052-8d32-d5398796b364

13.3.4 Noise and vibration sensitive receptors within the study area will be defined using professional judgement alongside guidance within *DMRB LA 111* and any consultation feedback from local authorities.

13.3.5 As a result of further ongoing work to understand the baseline environment and the preferred route announcement, it was considered appropriate to undertake some further detailed appraisal of alternative alignment routes at this stage. This only affects some of the schemes, and any alternatives that are still under consideration at the time of submitting this ESR are clearly identified in Chapter 2: The Project. The final study area is therefore likely to be different for each scheme. It is possible that the road links with potential to experience a short-term Basic Noise Level (BNL) change of more than 1.0dB(A) as a result of the project will change based on which of these alternatives is chosen. As a result, each scheme will necessitate its own routewide study area.

Construction noise

13.3.6 Where construction noise has been scoped in, following the scoping process in *DMRB LA 111* Figure 3.4N Scoping process for construction noise, assessment is made following the methodology defined in *DMRB LA 111*.

13.3.7 A study area of 300m from the closest construction activity is described in *DMRB LA 111* as normally sufficient to encompass noise sensitive receptors as stated in Section 3.5 Study Area, Note 1 .

13.3.8 A diversion route study area is required where the project is likely to require full carriageway closures overnight (23:00-07:00). Diversion route study areas are 25m from the kerbline of all designated diversion route roads.

13.3.9 BNL increase from construction traffic is to be assessed within a study area of 50m of all public roads likely to experience a 25% increase in flow (correlating to a 1dB increase in noise).

Construction vibration

13.3.10 Where construction vibration has been scoped in, following the scoping process in *DMRB LA 111* Figure 3.28N, assessment is made following the methodology defined in *DMRB LA 111*.

13.3.11 A qualitative construction vibration assessment is undertaken within a study area of 100m from the closest construction activity, as a worst-case assumed to be at the indicative DCO boundary.

Operation

13.3.12 The operational noise study area will be based upon the requirements of the *DMRB LA 111.*

13.3.13 The study area in accordance with *DMRB LA 111* will be defined by the following process:

- An area 600m from new road links, altered or road links bypassed by the project.
- An area 50m from any road with the potential to experience a short-term flow increase of greater than 25% or decrease of greater than 20% (1dB change).

13.3.14 Operational vibration is scoped out of the assessment methodology as a maintained road surface will be free of irregularities as part of project design and under general

maintenance, so operational vibration will not have the potential to lead to significant adverse effects.

13.4 Overview of consultation to date

13.4.1 Table 13-1 identifies the key comments that have been received to date from external consultees on the scope and approach to the noise and vibration assessment.

Table 13-1: Noise and Vibration Scope Comments to Date

Respondent	Comment	How Addressed / To be Addressed
Durham County Council, email, 4 January 2020	Confirmed acceptance of proposed approach to noise assessment. Passed on details of Durham consultants (AECOM).	No further action required.
Eden District Council, email, 1 March 2021	Confirmed acceptance of proposed approach to noise assessment. Raised query regarding low traffic flows due to Coronavirus restrictions and influence on noise levels.	Replied by email to advise that traffic flows used in the noise model would be representative of 'normal' conditions.
Richmondshire District Council, email, 7 April 2021	Response awaited.	Not applicable.

13.5 Baseline conditions

13.5.1 A desk-based review of the surrounding area along the existing route corridor indicates that the local area is predominantly rural and subjectively the main source of noise would be expected to be road traffic using the A66 itself.

13.5.2 Baseline noise surveys are planned for June 2021, as required in *DMRB LA 111* operational noise assessment. These baseline surveys will be used to inform baseline noise modelling results for the operational phase. Noise surveying information may also be used to assist the construction noise assessment.

13.5.3 Environmental noise surveys will be undertaken to capture existing prevailing conditions around the project. However, if future restrictions are imposed by the government in relation to Covid-19, the question of how representative baseline noise surveys would be of a normal noise environment will be considered. It is anticipated that traffic counts will be available during the surveys and that any discrepancy between predicted and observed levels will be assessed and discussed as required. Consideration will be given to the jointly-issued guidance by the Institute of Acoustics (IOA) and the Association of Noise Consultants (ANC). This guidance states that site surveys should only take place if they can be carried out in complete accordance with current government requirements (ANC and IOA, 2020)[194] and have recommended

[194] Acoustics and Noise Consultants and Institute of Acoustics (2020) Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments, available at: https://www.ioa.org.uk/sites/default/files/Joint%20Guidance%20On%20the%20Impact%20of%20Covid.IOA%20ANC%20V4.pdf

alternative techniques to determine baseline conditions; such as using previous environmental noise level surveys and noise prediction maps. This will be discussed with the local authorities as the need arises.

13.5.4 Within the route corridor the main settlement areas are: Penrith, located at the western end of the A66; Appleby-in-Westmorland, Brough, Bowes and Barnard Castle sited along the route corridor; and Middleton Tyas at the eastern end of the route corridor.

13.5.5 There are many other receptors within close proximity of the existing A66, such as the North Pennines Area of Outstanding Natural Beauty (AONB) (refer to Chapter 11: Landscape and Visual), North Pennine Moors Special Protection Area (SPA) and Special Area of Conservation (SAC), the River Eden SAC (refer to Chapter 7: Biodiversity), several scheduled monuments (refer to Chapter 9: Cultural Heritage), Public Rights of Way (PRoW), community facilities and schools (refer to Chapter 14: Population and Human Health). These receptors will be considered in line with *DMRB LA 111*.

Noise important areas

13.5.6 Noise Important Areas (NIAs) are locations in England where the top 1% of the population that are affected by the highest noise levels are located, according to the results of the strategic noise mapping undertaken by Defra, under the terms of the *Environmental Noise (England) Regulations 2006 (as amended)* (Legislation, 2006)[195].

13.5.7 The following NIAs have been identified within 1km of the existing route corridor which are the responsibility of Highways England (Defra, 2019)[196] (see Figure 13.1 in Chapter 18: Figures):

- Defra Important Area, 10127, Highways England
- Defra Important Area, 10128, Highways England
- Defra Important Area, 10230, Highways England
- Defra Important Area, 10284, Highways England
- Defra Important Area, 10437, Highways England
- Defra Important Area, 10438, Highways England
- Defra Important Area, 12113, Highways England
- Defra Important Area, 6763, Highways England
- Defra Important Area, 10283, Highways England

13.5.8 The following NIAs have been identified within 1km of the route corridor which are the responsibility of Cumbria County Council:

- Defra Important Area, 10285, Cumbria County Council
- Defra Important Area, 10286, Cumbria County Council

[195] Legislation (2006b) Environmental Noise (England) Regulations, available at: https://www.legislation.gov.uk/uksi/2006/2238/pdfs/uksi_20062238_en.pdf
[196] Department for Environment, Food & Rural Affairs (2019b) Noise Action Plan: Roads, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/813666/noise-action-plan-2019-roads.pdf

13.6 Potential impacts

Construction Noise

13.6.1 There is potential for impacts from noise and vibration during construction due to the following:

- Noise from the operation of construction plant
- Noise from Heavy Goods Vehicle (HGV) movements on the public highways to and from the site
- Noise and vibration from road traffic using diversion routes during night-time hours at noise-sensitive receptors within 25m
- Vibration from construction activities, such as earthworks

13.6.2 The magnitude of construction noise and vibration impacts is dependent on the nature of the proposed construction works and the proximity of sensitive receptors, and the existing ambient noise level.

13.6.3 Construction traffic can have a temporary adverse impact on sensitive receptors located along existing roads used by these vehicles. The potential for such impacts is dependent on the volume and route of construction traffic and impacts will be either beneficial or adverse and will be classified as either negligible, minor, moderate, or major in line with *DMRB LA 111*.

13.6.4 At the time of writing there is limited information relating to the construction methodology that will be used for the project. Where necessary, professional judgement will be used to establish the most likely construction programme based on standard construction techniques used on similar schemes.

13.6.5 A desktop level review indicates that Penrith, Temple Sowerby, Kirkby Thore, Crackenthorpe, Appleby-in-Westmorland, Warcop, Brough/Church Brough, Bowes and Greta Bridge have relatively large numbers of residential receptors within 300m of the route.

13.6.6 Some receptors within the 300m construction noise study area may experience an adverse construction noise impact, particularly if works are required to be undertaken during the night. However, it is not known at this stage if night-time work will be necessary. It is anticipated that more detail on working hours (and any relevant controls) will be available prior to submission of and will be reported in, the ES.

Construction vibration

13.6.7 The construction vibration generated by the project has the potential to adversly affect vibration-sensitive receptors and stakeholders may have a reasonable expectation that a construction vibration assessment will be undertaken at vibration sensitive receptors. Therefore, in line with *DMRB LA 111*, a construction vibration assessment will be undertaken at Preliminary Design.

13.6.8 Vibration, resulting from high emission plant such as vibratory rollers, has the potential to result in significant impact at receptors within 100m.

13.6.9 Penrith, Temple Sowerby, Kirkby Thore, Crackenthorpe, Appleby-in-Westmorland and Brough/Church Brough have relatively large numbers of residential receptors within100m.

Operation

13.6.10 Based on the scale of the project and the information provided in the Option Selection stage *Environmental Assessment Report (EAR)* (Highways England, 2018)[197], the operation of the project is likely to cause a change in the BNL of +/-1dB$L_{A10,18hr}$ in the Do-Minimum Opening Year (DMOY) compared to the Do-Something Opening Year (DSOY).

13.6.11 The project brings the road closer to some receptors, and further away from others. The magnitude of the operational traffic noise impact at a receptor is dependent on a range of factors including the traffic flow, composition, speed, road surface, ground topography, the presence of intervening buildings/structures and the distance to the road.

13.6.12 Impacts have the potential to be either beneficial or adverse and will be classified as either negligible, minor, moderate, or major in line with *DMRB LA 111*. Beneficial impacts could be, for example, reduced levels of disturbance and improved health and quality of life where traffic noise levels are reduced by the project. Adverse impacts could be, for example, increased disturbance and risk of reduced health and quality of life where traffic noise levels are increased by the project.

13.6.13 The project would operate 24 hours a day, seven days a week following commissioning and there is potential for operation of the project to affect (adversely or beneficially) both existing daytime and night-time noise levels.

13.7 Design, mitigation and enhancement measures

Design

13.7.1 The objective of design of the project would be to minimise the impacts on the existing acoustic environment consistent with government policy on sustainability. This would aim to minimise those receptors adversely affected by the project either during its construction or operational phases i.e. the application of mitigation measures would be designed with the aim of avoid potential significant effects.

Mitigation

13.7.2 Any necessity for mitigation will be identified following the *DMRB LA 111* assessment for both construction and operational phases.

13.7.3 Where appropriate, the feasibility of proposed noise mitigation measures will be established through a cost-benefit assessment which considers the degree of attenuation, alongside the cost of the mitigation measure and any other potential impacts arising from the mitigation, such as visual intrusion.

Construction

13.7.4 Any identified potential significant adverse effects associated with construction noise and vibration, would be mitigated with the development of appropriate construction methodologies set out in an Environmental Management Plan (EMP) and Noise and Vibration Management Plan (NVMP).

13.7.5 The EMP and NVMP would be prepared and agreed with local authorities prior to commencing construction. This would be the responsibility of the appointed

[197] Highways England (2018) A66 PCF Stage 2 Environmental Assessment Report

contractor. An outline EMP will be produced at and submitted as part of the DCO application.

13.7.6 Best practicable means (BPM) of working, as described in BS 5228, would be employed during the construction phase.

Operation

13.7.7 Mitigation of operational road traffic noise may include (but not be limited to) screening (i.e. noise barriers and/or earth bunds) or low-noise surfacing or a combination of these. Examples of design and mitigation techniques that may influence noise and vibration impacts are described below:

- Environmental barriers. These can be in the form of earth mounding or acoustic fencing of various types, or a combination of the two. Environmental barriers are not effective in reducing groundborne vibration and may be only partially effective against airborne vibration. The use of reflective and absorptive barriers could also be considered.
- Low-noise surfaces. The principal benefit of low-noise surfaces is the reduction in mid and higher frequency noise generated by tyres at speeds in excess of 75km/h. They are less effective in reducing noise at low speeds where engine noise particularly from heavy vehicles is more dominant and may not be viable for some sections of the route such as those at higher altitudes.

13.7.8 The potential benefits of mitigation measures vary widely according to circumstances. For example, environmental barriers can provide reductions of 10dB or more for well-screened locations relatively close to the source. But where the barrier is close to neither source nor receiver noise reductions may be negligible. Beyond 200-300m, the effects are often negligible as ground attenuation becomes the most significant factor.

13.7.9 Reducing the noise and vibration impact from a road scheme is just one of the factors to be considered in design, and conflicts can exist. Consideration will be given to cases where such conflict may exist, e.g. an acoustic barrier may introduce unacceptable visual intrusion or safety implications.

13.7.10 The NIR state that the highway authority must offer insulation to all qualifying buildings. The highway authority is encouraged to make the offer prior to construction of the road so that residents may benefit during the construction period. Noise insulation works usually consist of an openable secondary window within the existing window or, where practicable, a second door behind each qualifying external door that opens into an eligible room. As part of the EIA it may be possible to ascertain whether any receptors are anticipated to qualify under the terms of the NIR. If so, it may be appropriate to propose mitigation in the ES to obviate the need for offers or grants for insulation.

13.7.11 Any proposed mitigation will be designed in the context of government policy on noise and sustainable development.

Enhancement

13.7.12 The project will consider opportunities to reduce traffic noise levels in NIA and so improve health and quality of life for residents in those areas where the baseline levels are highest.

13.8 Description of the likely significant effects

13.8.1 The likely significant effects from construction and operational phases are summarised as follows:

Construction

13.8.2 The construction phase may give rise to a significant effect due to construction noise and vibration for dwellings along the project.

13.8.3 It is anticipated that mitigation of noise from any daytime construction activities, will avoid any residual significant adverse effects. Any works taking place during night time hours, if there is no practicable alternative to night-time working, may have the potential to result in a significant effect.

Operation

13.8.4 The project has the potential to affect existing ambient noise, during operation, in the following ways:

- Change in road traffic noise levels at sensitive receptors within the operational study area.
- Noise could be affected (positively or negatively) by changes in vehicle flow, speed and composition on the existing road network as a result of the preferred route.

13.8.5 In areas already experiencing high noise levels, even a small increase in road traffic noise levels could have the potential to cause a significant effect.

13.8.6 This is reflected in *Planning Practice Guidance – Noise (PPGN)* (Ministry of Housing, Communities and Local Government, 2019a)[198]. The guidance notes state that *"In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur (Paragraph: 006)".*

13.8.7 The operation phase is likely to result in both perceptible increases and decreases in road traffic noise level of greater than 1dB(A) along the project within each scheme.

M6 Junction 40

13.8.8 This scheme was not assessed in the Option Selection stage *EAR*; however, there is potential for adverse effects at noise sensitive receptors located nearby, as the junction improvements will reduce congestion and increase vehicle speed.

M6 Junction 40 to Kemplay Bank Roundabout

13.8.9 The scheme has potential to give rise to adverse effects at noise sensitive receptors located in Penrith, Eamont and other areas within close proximity to the alignment. These increases in noise levels will be a result of reduced congestion at the roundabout causing vehicles to travel at higher speeds through the preferred route extents.

Penrith to Temple Sowerby (Center Parcs)

[198] Ministry of Housing, Communities and Local Government (2019a) Planning Policy Guidance Note – Noise, available at: https://www.gov.uk/guidance/noise--2

13.8.10 The project has potential to give rise to both adverse and beneficial effects at noise sensitive receptors located near the A66. These changes are predicted as the preferred route moves the A66 alignment from noise sensitive receptors in the north and nearer to receptors in the south.

Temple Sowerby to Appleby

13.8.11 It should be noted that this scheme is currently subject to further alternative alignment routes assessment, in part due to the potential impacts associated with the crossing of Trout Beck. Alternative alignments under consideration include crossing Trout Beck further to the east, further to the west (closer to Kirby Thore) or a largely online route to the south of Kirby Thore. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected route.

13.8.12 Subject to confirmation of a final alignment, this scheme has potential to give rise to both beneficial and adverse effects at noise sensitive receptors located in Kirkby Thore. These changes are predicted as the project by-passes the village of Kirkby Thore while the existing A66 route currently goes through the village. However, the proposed route will be nearer noise sensitive receptors in the north of the village.

13.8.13 The Crackenthorpe section of the scheme has potential to give rise to beneficial effects at noise sensitive receptors located in Crackenthorpe and adverse effects at receptors located near the proposed new route. These changes are predicted as the scheme moves the A66 away from the settlement of Crackenthorpe to the north. The majority of receptors in close proximity to the existing A66 may experience a relatively large decrease in noise levels.

Appleby to Brough (Warcop)

13.8.14 As with the Temple Sowerby to Appleby section, this scheme is also subject to further alternative alignment routes assessment due to its close interaction with the North Pennines Area of Outstanding Natural Beauty (AONB). Alternative alignments immediately north of Warcop and an alternative tie-in further east along the existing A66 are under consideration. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected route.

13.8.15 Subject to confirmation of a final alignment, this scheme has potential to give rise to adverse effects to noise sensitive receptors, particularly those located to the south of the A66. These changes are predicted as the existing carriageway will be used for the eastbound traffic and a new westbound carriageway will be constructed south of the existing road.

Bowes Bypass (A66/A67)

13.8.16 The scheme has potential to give rise to adverse effects to noise sensitive receptors particularly those located to the north of the A66. These changes are predicted as the existing carriageway will be used for the westbound traffic and a new eastbound carriageway will be constructed north of the current road.

Cross Lanes to Rokeby

13.8.17 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected option.

13.8.18 Subject to confirmation of a final alignment, this scheme has potential to give rise to adverse effects to noise sensitive receptors to the south and beneficial effects to a

number of receptors to the north of the existing A66. These changes are predicted as the preferred route moves the A66 approximiately 60m south. This is anticipated to result in beneficial effects at receptors to the north. However, noise levels to the south of the existing A66 are anticipated to increase.

Stephen Bank to Carkin Moor

13.8.19 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected option.

13.8.20 Subject to confirmation of a final alignment, this scheme has potential to give rise to both beneficial and adverse effects at noise sensitive receptors near the alignment. The majority of sensitive receptors are anticipated to be adversely impacted. These changes are predicted as the scheme moves the A66 north of the existing route, resulting in potential beneficial effect at receptors to the south of the exisiting A66 and an adverse effect at receptors to the north.

A1(M) Junction 53 Scotch Corner

13.8.21 This scheme was not assessed in the Option Selection stage *EAR*; however, there is potential for adverse effects to noise sensitive receptors located nearby as the junction improvements will reduce congestion and increase vehicle speed.

13.9 Assessment methodology

Value of environmental receptors

13.9.1 The noise and vibration assessment methodology follows *DMRB LA 111* which does not assign values to environmental receptors. Noise and vibration sensitive receptors will be defined using *DMRB LA 111* and professional judgement. These will include but may not be limited to:

- Residential dwellings
- Hospitals
- Schools
- Community facilities
- Places of worship

13.9.2 Topic-specific receptors, such as receptors of interest to biodiverstiy and cultural heritage will be detailed in their respective chapters. Modelling for these topic-specific receptors will be carried out and resulting noise predictions provided to those respective assessments.

Levels of LOAEL and SOAEL assumed for road traffic schemes

13.9.3 PPGN introduces the concept of observed effect levels as Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL). Values for noise sources associated with road schemes are defined in *DMRB LA 111*.

13.9.4 The LOAEL is the level of noise exposure above which adverse effects on health and quality of life can be detected. The SOAEL is the level of noise exposure above which significant adverse effects on health and quality of life occur.

13.9.5 The LOAEL and SOAEL values for construction, vibration and operation are presented in the following *DMRB LA 111* tables:

- Construction noise: Table 3.12

- Construction vibration: Table 3.31
- Operational noise: Table 3.49.1

13.9.6 The daytime SOAEL for road traffic noise is aligned with the Noise Insulation Regulations (NIR) threshold level of 68dB $L_{A10,18hr}$.

Construction

13.9.7 LOAEL and SOAEL values will be set for all noise sensitive receptors within the study area, for time periods when they are in use.

13.9.8 Construction noise and vibration will be predicted and assessed using the guidance set out in the following British Standards (in accordance with *DMRB LA 111*):

- BS 5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites. Noise'* (BS5228-1) (British Standard, 2014a)[199].
- BS 5228-2:2009+A1:2014 *'Code of practice for noise and vibration control on construction and open sites. Vibration'* (BS5228-2) (British Standard, 2014b)[200].

13.9.9 *BS 5228-1* provides guidance on predicting and measuring construction noise and assessing its impact on the environment.

13.9.10 *BS 5228-2* provides recommendations for basic methods of vibration control and methods of assessing its impacts of construction vibration on the environment.

13.9.11 If the construction details required to apply these assessment methods are not available, then a high level commentary would be provided instead, including a risk-based consideration of construction impacts.

Operation

13.9.12 The operational assessment of the project will be undertaken in accordance with *DMRB LA 111* and will cover operational road traffic noise.

13.9.13 Road traffic noise calculations will be undertaken in accordance with the methodology contained within the Department of the Environment and the Welsh Office *'Calculation of Road Traffic Noise'* (CRTN) (Department for Transport, 1988)[201] in compliance with *DMRB LA 111* and *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)[202]. The prediction of road traffic noise effects will be undertaken using a proprietary and appropriately-validated 3-dimensional noise mapping software package such as NoiseMap.

13.9.14 In accordance with the assessment method defined within *DMRB LA 111*, the following comparisons will be made for road traffic noise levels to consider the impacts of the preferred route in both the short and longer term:

- Short-term; Do-minimum Opening Year vs Do-Something Opening Year
- Long-term; Do-minimum Opening Year vs Do-Something Future Year
- Non-project noise; Do-minimum Opening Year vs Do-Minimum Future Year

[199] British Standard (2014a) BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on construction and Open Sites.
[200] British Standard (2014b) BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on construction and Open Sites
[201] Department for Transport (2014b). Calculation of Road Traffic Noise.
[202] Department for Transport (2014) National Policy Statement for National networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf

13.9.15 A road traffic noise prediction model would consider horizontal and vertical alignment, ground topography and acoustically-significant features (e.g. barriers, building mass, etc.).

13.9.16 The project assessment will utilise the following data sets:

- Traffic data:
  - 18-hour Annual Average Weekly Traffic (AAWT) total traffic flows
  - 18-hour percentage heavy vehicles (greater than 3.5 tonnes in weight)
  - Traffic data will be subject to the speed pivoting process set out in *DMRB LA 111* Appendix A
- Geographic data sets:
  - Ordnance survey mastermap topography layer
  - Ordnance survey addressbase layer
  - Noise action planning important areas GIS layer
  - Project alignment drawings

13.9.17 Short and long-term night-time noise impact will require assessment in accordance with *DMRB LA 111*.

13.9.18 All predictions and comparisons will be presented in the reporting tables as specified in *DMRB LA 111* and reported accordingly. The significance of any effects will be reported in line with Highways England's guidance and the requirements of National Policy (*NPSNN, Noise Policy Statement England (NPSE)* (Department for Environmental, Food and Rural Affairs, 2010)[203], *Noise Planning Policy Framework NPPF* (Ministry of Housing, Communities and Local Government, 2019b)[204]).

13.9.19 Significance assessment at ES stage will follow the method outlined in DMRB LA 111. Short-term impact magnitudes will be used to determine an initial significance; contextual factors in *DMRB LA 111* Table 3.60 (e.g. absolute noise, long term/short-term comparison and acoustic context) will then be considered in the determination of final operational significance.

13.9.20 The construction and operational noise assessments will inform where mitigation should be considered, i.e. at receptors where noise increases from the project are anticipated to result in a significant adverse effect. The mitigation measures discussed above will be considered and modelled, where appropriate. An assessment will take place to determine whether the proposed mitigation measures are feasible and consistent with government policy on sustainability set out in the *NPSNN*. The application of such mitigation measures would mitigate and minimise any identified potential significant effects as far as is practicable and sustainable.

13.9.21 Noise screening requirements must be balanced against other environmental considerations such as landscape, visual intrusion and cost-benefit in accordance with *DMRB LA 111* which references the policy in the *NPSNN*. The optimised mitigation solution will be developed on a multi-disciplinary basis with the environmental team.

[203] Department for Environment, Food & Rural Affairs (2010) Noise Policy Statement for England, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

[204] Ministry of Housing, Communities and Local Government (2019b) National Planning Policy Framework, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf

13.9.22 The consideration and appraisal of mitigation measures will consider the aims of the *NPSE*, which are to:

- Avoid significant adverse impacts on health and quality of life from noise as a result of the new development.
- Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development.
- Contribute to improvements to health and quality of life through the effective management and control of noise, where possible.

13.9.23 As per Section 1.4 of *DMRB LA 111*, operational vibration is scoped out of the assessment as a maintained road surface will be free of irregularities as part of project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects. Therefore, operational vibration will not be considered further in the EIA.

13.10 Assessment assumptions and limitations

13.10.1 No baseline noise surveys were undertaken as part of the previous Option Selection stage *EAR*. Baseline noise surveys will be completed to inform baseline noise modelling as part of the EIA, as described in *DMRB LA 111*.

13.10.2 Speed pivoting is to be applied to all traffic data in accordance with the method in *DMRB LA 111* Appendix A4. The type of road surfacing will be established with the design team, if such data are not available it will be assumed to be worst case. The appropriate correction, taken from *DMRB LA 111*, will be included in the noise prediction modelling.

13.10.3 Due to potential future restrictions imposed by the government in relation to Covid-19, the question of how representative baseline noise surveys would be of a normal noise environment will be considered (see paragraph 13.5.3).

13.10.4 If appropriate and up-to-date details on the existing pavement of roads (i.e. whether they have low noise surface or not) is not available, it will be assumed that the principaL A roads and motorways in the study area have a low noise surface for both the Do-Minimum and Do-Something scenario, since this leads to a cautious assessment of any reduction in noise that would be brought about by applying a low or very low noise surface. All other roads are assumed to be hot rolled asphalt.

13.10.5 The following limitations and assumptions will be applied to the assessment of construction noise and vibration:

- The assessment will be based on the current method statement and designs. Should changes to the design arise, the assessment should be amended accordingly.
- Plant and equipment required to construct the project will be assumed based on experience and professional judgement.

13.10.6 Due to prevailing and potential future restrictions imposed by the government in relation to Covid-19, baseline surveys may be not representative of normal conditions. In jointly-issued guidance, the IOA and ANC stated that site surveys should only take place if they can be carried out in complete accordance with current Government requirements and have recommended alternative techniques to determine baseline conditions; such as using previous environmental noise level surveys and noise prediction maps. This will be discussed with the local authorities as the need arises.

Table 13-2: Noise and Vibration scoping criteria from DMRB *LA 111* – construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Noise:										
1) does construction noise generated by the project have the potential to adversely affect any noise sensitive receptors?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2) are there any noise receptors where there would be a reasonable stakeholder expectation that a construction noise assessment would be undertaken?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vibration:										
1) does vibration from construction have the potential to adversely affect any vibration sensitive receptors?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2) does the scale of the development or type of construction mean that there will be a reasonable stakeholder expectation that a construction vibration assessment would be undertaken at any vibration sensitive receptors?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Key Mitigation	N/A - At Option Selection stage there were no calculations of construction noise and vibration and therefore no mitigation was assumed. As per *DMRB LA 111*, a construction and vibration assessment will be required for the EIA.									
Proposed Scope (In) At Option Selection stage there were no calculations of construction noise and vibration. As per *DMRB LA 111*, a construction noise and construction vibration assessment will be required for the EIA.	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In
Proposed Scope (Out)	-	-	-	-	-	-	-	-	-	-

Table 13-3: Noise and Vibration criteria from *DMRB LA 111* - operation

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Noise:										
1) is the project likely to cause a change in the BNL of 1dB $L_{A10,18hr}$ in the do-minimum opening year (DMOY) compared to the do-something opening year (DSOY)?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2) is the project likely to cause a change in the BNL of 3dB $L_{A10,18hr}$ in the do-something future year (DSFY) compared to the DMOY?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3) does the project involve the construction of new road links within 600m of noise sensitive receptors?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4) would there be a reasonable stakeholder expectation that an assessment would be undertaken?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Key Mitigation	Mitigation in the form of barriers was not included in the Option Selection stage assessment. Moreover, it was assumed there was no vertical alignment i.e. flat ground throughout. The assessment of noise barriers will be undertaken in detail for the EIA. At Option Selection stage, where new carriageways are to be constructed, a thin surfacing system was assumed.									
Proposed Scope (In)	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In	Scope In
Proposed Scope (Out)	-	-	-	-	-	-	-	-	-	-

14 Population and Human Health

14.1 Introduction

14.1.1 This chapter outlines the proposed scope of assessment to be undertaken for population and human health.

14.1.2 Population and human health considers the impacts of the construction and operation of the project on the following sub-topics, with particular attention to vulnerable groups:

- Private property and housing: the location and number of both residential and commercial properties at risk of demolition, or from which land will be required or have access affected.
- Community land and assets: the location and number of community land and assets (e.g. recreational assets) alongside their frequency of use and their level of existing accessibility.
- Development land and businesses: the location and number of businesses (and associated jobs) at risk or from which land will be required or have access affected. Likewise, the location of land allocated for development by local authorities and the number of future jobs that will be affected by a project.
- Agricultural land holdings: the type, location and number of agricultural holdings at risk of demolition or from which land will be required/access affected by a project.
- Walkers, cyclists and horse riders (WCH): the type, location and extent of WCH provision (e.g. public rights of way (PRoW)) within the study area and their frequency of use.
- Health effects associated with changes in environmental conditions.
- Health effects associated with severance/accessibility and the ability of communities to access community land, assets and resources.

14.1.3 There may be interrelationships between the potential effects on population and health and other disciplines. Therefore, please refer to the following chapters:

- Chapter 6: Air Quality
- Chapter 10: Geology and Soils
- Chapter 11: Landscape and Visual
- Chapter 13: Noise and Vibration

14.1.4 The methodology used will follow the requirements of *DMRB LA 112 Population and Human Health Revision* 1 *(DMRB LA 112)* (Highways England, 2020)[205].

14.2 Key Questions for scoping

1. Do you agree with the proposed scope of the population and human health assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the population and human health assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments?

[205] Highways England (2020) Population and human health LA 112, available at: https://www.standardsforhighways.co.uk/dmrb/search/1e13d6ac-755e-4d60-9735-f976bf64580a

4. Are there any other key issues or aspects relevant to the population and human health assessment that you wish to bring to the attention of the design and assessment team?
5. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

14.3 Study area

Population

14.3.1 In accordance with *DMRB LA 112*, the study area shall be based on the construction footprint/project boundary (the indicative Development Consent Order (DCO) boundary including compounds and temporary land take) plus a 500m buffer area. Likely significant adverse effects are not anticipated outside a 500m buffer due to the aims and objectives of the project which seek improvements to the route, making the A66 more reliable and accessible.

14.3.2 Where likely effects are identified outside the 500m area surrounding the indicative DCO boundary, the study area will be extended accordingly. For example, the population study area may be extended to potentially include any settlements that lie partially within 500m of the existing A66 alignment. This will be defined fully within the Environmental Statement (ES).

14.3.3 Where effects are unlikely to occur within the 500m area surrounding the indicative DCO boundary, the study area will be reduced accordingly.

Human health

14.3.4 In line with *DMRB LA 112*, the study area shall be defined based on the following:

- The extent and characteristics of the project.
- The communities/wards directly and indirectly affected by the project, as described in Section 14.3.

14.3.5 The study area will focus on communities located within 500m of the project. If changes to health determinants are identified in proximity to communities outside this area (e.g. due to impacts identified by other EIA topics) then these will also be considered in the assessment.

14.4 Overview of consultation to date

14.4.1 Table 14-1 identifies the key comments that have been received to date from external consultees on the scope and approach to the population and human health assessment.

Table 14-1: Population and human health scope comments to date

Respondent	Comment	How Addressed /to be addressed
Durham County Council (DCC) (Access and Rights of Way Team Leader)	Commented on scope and approach to the assessment, summarised below: 1. PRoW and recreational access have not been specifically identified within the scoping assessment.	The responses to the comments raised by DCC are summarised below. 1. Environmental Scoping Report (ESR) identifies PRoW and recreational

Respondent	Comment	How Addressed /to be addressed
	2. Some existing PRoW that legally cross the A66 will inevitably be severed, and those impacts need to be properly assessed and appropriate measures provided. Previous arrangements for at-grade crossings are no longer safe or viable as traffic levels have risen. 3. Specific stakeholder consultations are underway in respect of non-motorised users (NMU) (walkers, cyclists and horse-riders), and it is hoped that the matter will be addressed as strategically as possible so that opportunities are taken to maximise linkages with the routes affected by the existing dual-carriageway sections. 4. Any existing PRoW and proposed new routes for NMU, need to be assessed in terms of the impacts of noise, air quality, landscape and visual effects and human health. 5. Impacts of the project will be experienced by people travelling at low speeds who will be exposed to noise and pollution, and any visual effects for longer. It is important that PRoW and recreation are not treated in isolation from the wider assessments on noise, landscape etc. 6. Recommends that reference is made to a recent publication on *Appraising Access* (Institute of Environmental Management and Assessment, 2020)[206] as part of Environmental Impact Assessments (EIA)	access within Section 14.5 for each scheme. 2. The Environmental Statement (ES) will identify and assess any likely significant effects. The most up to date freely available traffic count points from Department for Transport (DfT) will be used in determining the sensitivity of a PRoW crossing at-grade within the scheme extents. 3. The WCH assessment considers potential enhancements to existing provision. Embedded mitigation and enhancement will be considered as per 3.17 *DMRB LA 112*. 4. Population assessment methodology in *DMRB LA 112* does not require 'amenity' or other impacts to be considered (related issues are addressed in the Health assessment element of *DMRB LA 112*). 5. PRoW/WCH significance is based only on journey length (increase or decrease). WCH assessment will influence the design of facilities. 6. Highways England adheres to its own guidance and procedures to ensure PINS and stakeholders are presented with consistent information across their schemes. If DCC can provide a copy of this guidance, it will be reviewed to ascertain if it aligns with *DMRB LA 112*.

[206] Institute of Environmental Management and Assessment (2020) Environmental Impact Assessment Guide to: Major Accidents and Disasters, available at: https://www.iema.net/resources/blog/2020/09/23/iema-major-accidents-and-disasters-in-eia-primer

Respondent	Comment	How Addressed /to be addressed

14.5 Baseline conditions

14.5.1 It should be noted that some schemes are currently subject to further alternative alignment routes assessment. The following section describes the baseline features throughout the routewide study area where route alternatives are under consideration.

Population

14.5.2 This section outlines the population baseline and is based upon the Option Selection stage *Environmental Assessment Report (EAR)* (Highways England 2018)[207], as well as any additional information which has been collated since. Figure 14.1 visually represent their locations in relation to the schemes. The baseline section focuses upon identifying the population receptors, as listed in paragraph 14.1.2, within the study area of each scheme.

14.5.3 The community assets, residential receptors, business receptors and PRoW assessed in the EIA will be determined with reference to the final scheme design for the relevant scheme..

14.5.4 Table 14-2 below sets out Population baseline conditions within the study area. The study area has been defined in line with *DMRB LA* 112 to be 500m area surrounding the indicative DCO boundary.

Table 14-2: Population Baseline Conditions

Scheme	Receptor	Description
M6 J40	Private property and housing	Private property and housing receptors are located within the study area including receptors within Penrith. Penrith is a market town, which lies less than 4km from the boundary of the Lake District National Park.
	Community land and assets	There are numerous community land and asset receptors located at this scheme. Skirsgill Park is located within 50m of the scheme and is located to the south.
	Development land and businesses	There are numerous business receptors surrounding the scheme, including those within Skirsgill Business Park and Penrith Industrial Estate.
	Agricultural land holdings	The surrounding land use is semi-urban in nature with key local land uses including the Penrith & District Farmers Auction Mart, approximately 100m to the north-west.
	WCH	This scheme has WCH provisions on the roundabout., which connect to other PRoW

[207] Highways England (2018) A66 PCF Stage 2 Environmental Assessment Report

Scheme	Receptor	Description
		including Greystoke and back cycle route and Footpath 321 008.
M6 J40 to Kemplay Bank roundabout	Private property and housing	Private property and housing receptors are located within the study area including receptors within Penrith. Penrith is a market town, which lies less than 4km from the boundary of the Lake District National Park. Land at Carleton Hall Farm, just outside Penrith, has been allocated as a site for housing in the *Eden Local Plan 2014-2031* Submission Draft (Eden District Council, 2018)[208]. The land is found between Carleton Avenue and the A66 approximately 200m to the north of the project and is 3.8ha in size.
	Community land and assets	Penrith has multiple community assets within 500m of the scheme: • North Lakes Primary School, approximately 350m to the north • Kings Church Eden, approximately 350m to the north • Penrith Cricket Club, approximately 450m to the north • two recreation grounds, approximately 50m and 150m to the north respectively • Penrith Hospital, approximately 100m to the north • Winters Park Residential Care Home, approximately 150m to the north • Penrith Rugby Union Club, approximately 100m to the north • Penrith Community Fire Station, approximately 50m to the south • Cumbria Constabulary, approximately 50m to the south • Carletonhall Park, approximately 300m to the south There is an area of safeguarded open space approximately 200m to the north in the Thacka Beck area, together with the Penrith Rugby Football Club.
	Development land and businesses	Multiple businesses are located within 500m of the project, including: • KFC restaurant approximately 50m to the north

[208] Eden District Council (2018) Eden Local Plan 2014-2032, available at: https://www.eden.gov.uk/media/5032/edenlocalplan2014-2032finalwithoutforeword.pdf

Scheme	Receptor	Description
		• B&M Home Store, approximately 250m to the north • ESSO Petrol Station, approximately 400m to the north There is land allocated for employment immediately to the south of this scheme. This is 'Land adjacent Skirsgill Depot', as part of the Eden District Council Local Development Plan.
	Agricultural land holdings	This Section includes areas of agricultural land. Land use is likely to comprise a mix of arable and grazing land. None of the land is currently understood to be within a Countryside Stewardship Scheme or woodland/forestry scheme.
	WCH	There are a number of PRoW found in close proximity to the project, with the following immediately adjacent to the A66: • Footpath 358 008#1 runs north south past Penrith Cricket Club towards the A66 / A6 roundabout • Footpath 358 008#2 runs north south on the opposite side to Footpath 358 008#1 • Footpath 358 006#1 runs north south from Carleton Avenue towards the A66 • The National Cycle Network (NCN) (Route 71) and Bridleway 358 040 run parallel to and cross the A66 at Frenchfield Sports Centre, running in a north south direction.
Penrith to Temple Sowerby (Center Parcs)	Private property and housing	The route runs through a sparsely populated section of the A66, which contains at least six residential properties all of which are located within approximately 100m of the project. The village of Temple Sowerby is just beyond the 500m study area, to the east.
	Community land and assets	There are a number of community assets within 500m of the project, including: • Frenchfield Sport Centre and a Recreational Ground, approximately 50m to the north • Brougham Castle, approximately 200m to the south • Barrackbank Wood, approximately 150m to the north • Whinfell Park, approximately 200m to the south

Scheme	Receptor	Description
		• Approximately 4km to the east of Penrith, the route passes to the north of the Whinfell Forest Center Parcs. The Lake District National Park is found less than 4km to the south of this section.
	Development land and businesses	Multiple businesses and private assets are located within 500m of the project, including: • Llama Karma Kafe, approximately 50m to the north • Phoenix Antiques Barn, approximately 100m to the south
	Agricultural land holdings	This section is predominately agricultural. Land use comprises a mix of arable and grazing land. None of the land is currently understood to be within a Countryside Stewardship Scheme. Some areas of woodland/plantation are likely to have felling licenses associated with them.
	WCH	There are a number of PRoW found in close proximity to the project. The following two PRoW are immediately adjacent to the A66 and are likely to be severed: • Footpath 311 004 runs in a north south direction from the A66 towards Center Parcs • Byway 311 013 runs in a north-easterly direction on the northern side of the A66 opposite Whinfell Park
Temple Sowerby to Appleby	Private property and housing	This section of the route spans between Temple Sowerby and Appleby. The small village of Crackenthorpe is found to the north-east of the A66 approximately 500m south west of the scheme and is made up of a small number of residential properties. The town of Appleby-in-Westmorland is located 1km to the south-east and is home to several residential, community and commercial properties. Within the 500m study area there are numerous private property and housing assets, including: • Eden View Farm, approximately 50m to the south • 1 and 2 Eden View Cottages, approximately 50m to the south • Winthorn, approximately 100m to the north • Spittals Farm, approximately 50m to the north

Scheme	Receptor	Description
		• Roman Vale, approximately 50m to the north • Rodger Head Farm, approximately 300m to the south • Colby Laithes, approximately 300m to the south
	Community land and assets	Multiple community assets are located within 500m of the project, including: • Low Moor Caravan and Camping Park, approximately 50m to the south • St Michaels Church, approximately 300m to the south • Kirkby Thore Primary School, approximately 200m to the south • Appleby Grammar School, approximately 300m to the south Temple Sowerby Manor/Acorn Bank National Trust Land lies approximately 1.2km north-west.
	Development land and businesses	There are numerous businesses located within 500m of this scheme, including British Gypsum and units located within Kirkby Thore Industrial Estate. Concentrations of businesses are located at Kirkby Thore and Appleby-In-Westmorland.
	Agricultural land holdings	This section is predominately agricultural. Land use comprises a mix of arable and grazing land. Some of the land is currently understood to be within an Entry Level Stewardship scheme with the potential for small areas of woodland to be under a Woodland Grant scheme.
	WCH	There are a number of PRoW found in close proximity to the project, with the following immediately adjacent to the A66: • Bridleway 336 007 runs in a north south direction from the west of Kirkby Thore towards the A66 • Bridleway 341 001 runs in an east west direction towards the north of Crackenthorpe • Footpath 317 009 runs in a north south direction to the north of the A66 • Footpath 341 017#1 runs in a north south direction from Long Marton towards the A66 • Footpath 341 005 runs in a north south direction to the north of Crackenthorpe

Scheme	Receptor	Description
		• Bridleway 341 001 runs in an east west direction towards the north of Crackenthorpe • Footpath 317 006 runs in a north south direction to the north of Crackenthorpe • Footpath 317 009 runs in a north south direction to the north of the A66 • Footpath 341 017#1 runs in a north south direction from Long Marton towards the A66 • Footpath 317 012 runs in a north south direction to the north of Crackenthorpe • Footpath 317 004#2 and Footpath 317 004#1 runs in a north south direction crossing the A66 towards the east of Crackenthorpe
Appleby to Brough (Warcop)	Private property and housing	This section of the route passes north of the town of Warcop. The village of Sandford lies approximately 800m south of the scheme. The interlinked villages of Brough and Church Brough are located approximately 600m to the east of the scheme and to the north and south of the existing A66 respectively. Within the 500m study area there are approximately 50 residential properties. There is a small area of allocated land for housing 'Rowan House' located immediately north of tis scheme, at Brough.
	Community land and assets	Multiple community assets are located within 500m of the project, including: • Open access land, adjacent to the western extents of the scheme • Two areas of open access land, approximately 200m to the south but north of Sandford • Open access land, approximately 100m to the north but south of Bale Hill

Scheme	Receptor	Description
	Development land and businesses	Multiple businesses and private assets are located within 500m of the project, including: • Dyke Nook Cottage, approximately 50m to the south • Warcop Training Area, approximately 250m to the south • Eastfield Farm, approximately 100m to the north • Café Sixty Six, located adjacent to the scheme • The Chamley Arms, approximately 400m to the south There is a small area of land allocated for employment north of this scheme, at Brough ('Trading Estate and Grand Prix Club'), as part of Eden District Council's Local Development Plan.
	Agricultural land holdings	This section is predominantly agricultural and there are multiple farm accesses off the A66 to the east of Warcop. Land use comprises a mix of arable and grazing land. A large proportion of the land is understood to be under Entry Level Stewardship Schemes, with some areas of woodland/plantation having associated Felling License applications in place.
	WCH	The NCN (Route 68) runs parallel to and crosses the A66 at Appleby, running in a north south direction. There are a number of PRoW found in close proximity to the project, with the following immediately adjacent to the A66: • Footpath 372 028 runs in a north south direction towards the A66 to the east of Coupland Beck • Bridleway 372 024 runs in a north south direction from the A66 towards the River Eden • Footpath 372 027#2 runs in a north south direction towards the A66 to the west of Taylor & Braithwaite • Footpath 372 022 runs in a north south direction from the A66 through the ground of Taylor & Braithwaite • Footpath 372 013 runs in a north south direction from the A66 to the east of Taylor & Braithwaite • Footpath 372 014 runs in a north south direction from the A66 towards Warcop

Scheme	Receptor	Description
		• Footpath 372 031 runs in a north south direction along Hayber Lane towards the A66 • Footpath 372 031 021#2 runs in a north south direction to the south of the A66 • Footpath 329 001 runs in a north south direction towards the A66 to the west of Brough • Footpath 372 020 runs in a north-east/south-east direction to the south of the A66
Bowes Bypass (A66/A67)	Private property and housing	Bowes Bypass runs north of the small village of Bowes. There are approximately 30 residential properties within Bowes that are located within 500m of the project.
	Community land and assets	Multiple community assets are located within 500m of the project, including: • Bowes Castle, approximately 250m to the south • Bowes Hutchinson Church of England Primary School, approximately 100m to the south • St Giles Church, approximately 250m to the south • Bowes Village Hall, approximately 250m to the south
	Development land and businesses	Multiple businesses are located within 500m of the project, including: • Clint House Farm, approximately 450m to the north • West End Farm, approximate 50m to the north • Annums Farm, approximately 100m to the south • The Ancient Unicorn Inn – public house and bed and breakfast • Stone Bridge Farm, approximately 50m to the south • Bowes Cross Farm, approximately 50m to the north • Amey Hulands Quarry, approximately 250m to the north-east There are two sites located east of this scheme allocated for minerals development; Hulands Quarry Extension (22.5ha, approximately 180m

Scheme	Receptor	Description
		east) and Kilmondwood Quarry (unknown ha, approximately 700m east).
	Agricultural land holdings	At this section, the North Pennines AONB is located immediately to the east. This section is predominantly agricultural. Land use comprises predominantly grazing land. None of the land is currently understood to be within a Countryside Stewardship Scheme or woodland/forestry grant scheme.
	WCH	There are a number of PRoW found in close proximity to the project, with the following immediately adjacent to the A66: • Footpath Bowes 6 runs in a north south direction crossing the A66 in Bowes • Bridleway Bowes 6 runs in a north south direction to the north of the A66 and east of Bowes
Cross Lanes to Rokeby	Private property and housing	This section of the route is sparsely populated and is characterised by isolated residential properties and farms. The village of Greta Bridge lies close to the eastern end, with the nearest houses approximately 100m from the scheme. Within the 500m study area at least four residential properties are located within 100m of the project with at least an additional three within 400m.
	Community land and assets	The Rokeby Park Registered Park and Garden is a community facility and is located approximately 400m to the north of the project.
	Development land and businesses	Multiple businesses are located within 500m of the project, including: • Cross Lanes Farm, approximately 50m to the south • The Cottage (Brik Hall Farm), approximately 100m to the south • Street Side Farm, approximately 50m to the north • The Old Rectory, approximately 400m to the north • Rokeby Grange Farm, approximately 400m to the north • Ewebank Farm, approximately 50m to the north • The Moritt Hotel and Garage Spa, approximately 400m south-east of the project.

Scheme	Receptor	Description
	Agricultural land holdings	This section is predominantly agricultural. Land use comprises predominantly arable land with some fields being grazed. It is likely that the majority of the land is under Entry-Level Stewardship schemes, with some woodland/plantation under a Woodland Grant Scheme.
	WCH	There are a number of PRoW found in close proximity to the project, with the following immediately adjacent to the A66: • Footpath Rokeby 9 runs in a north south direction to the north of the A66 • Footpath Rokeby 10 runs in a north south direction to the north of the A66 • Footpath Rokeby 5 runs in a north south direction to the north of the A66 • Footpath Rokeby 6 runs in a north south direction to the south of the A66 • Bridleway Rokeby 16 runs parallel to the southern side of the A66 before crossing the A66
Stephen Bank to Carkin Moor	Private property and housing	This section of the route passes to the north of the village of Ravensworth. The section route also passes to the south of the village of West Layton which is approximately 200m from this scheme. At least one residential property is located within 500m of the project and is found approximately 50m to the north.
	Community land and assets	No community facilities are located within 500m of the project. Ravensworth is home to a limited number of community facilities, including Ravensworth Church of England Primary School and a public house.
	Development land and businesses	Multiple businesses are located within 500m of the project, including: • Foxgrove Farm, approximately 50m to the north • Foxhall Inn, approximately 50m to the south • Foxwell Farm, approximately 100m to the north • Foxhall Caravan Park and Leisure Park, approximately 500m to the south • Mainsgill Farm, approximately 250m to the south

Scheme	Receptor	Description
	Agricultural land holdings	This section is predominantly agricultural. Land use comprises predominantly arable land with small woodland blocks. Some of the land is understood to be under an Entry Level Stewardship Scheme. Some of the woodland/plantation blocks are understood to be under a Woodland Grant Scheme.
	WCH	There are a number of PRoW found in close proximity to the project, with the following immediately adjacent to the A66: • Bridleway Hutton Magna 12 runs in a north south direction to the north of the A66 • Footpath 20.72/1/1 runs in a north south direction to the north of the A66 • Footpath 20.55/1/1 runs in a north south direction to the south of the A66 • Footpath 20.23/8/1 runs in a north south direction to the north of the A66 • Footpath 20.55/2/1 runs in a north south direction to the south of the A66 • Bridleway 20.55/6/1 runs in a north south direction to the south of the A66 • Bridleway 20.23/5/1 runs in a north south direction to the north of the A66 • Bridleway 20.30/8/1 runs in a north south direction to the north of the A66
A1(M) J53 Scotch Corner	Private property and housing	This section of the route is sparsely populated and is characterised by the Scotch Corner Motorway Service Areas and farms. There are a number of residential properties within 500m of the project and located to the west of Middleton Tyas. It is anticipated that there are less than 20 residential properties within 500m of the project.
	Community land and assets	No community facilities are located within 500m of the project
	Development land and businesses	Multiple businesses are located within 500m of the project, including: • Scotch Corner Caravan Club, approximately 100m to the west • Scotch Corner Motorway Service Area, approximately 100m to the north-east • Holiday Inn Darlington Scotch Corner, approximately 50m to the south • Scotch Corner Autos, approximately 200m to the south

Scheme	Receptor	Description
		• Gem Horseboxes, approximately 250m to the south An area of 'Preferred Strategic Direction of Growth' (Richmondshire District Council Local Development Plan) is located approximately 300m south west of this scheme.
	Agricultural land holdings	Small pockets of arable land with small woodland blocks are also common. Some of the land is understood to be under an Entry-Level Stewardship Scheme. Some of the woodland/plantation blocks are understood to be under a Woodland Grant Scheme.
	WCH	There are no PRoWs found in close proximity to the project.

Human health

14.5.5 The *DMRB LA 112* guidance sets out the information to be collated for the human health baseline, including baseline health profiles of the affected communities and information relating to heath determinants.

14.5.6 Baseline information relating to health determinants will be collated by other EIA topics and will be reviewed in order to establish the baseline conditions for the human health assessment. This will include:

- location and type of community, recreational and education facilities and severance/separation of communities from such facilities – reported under Population: Community land and assets
- location of green/open space and severance/separation of communities from such facilities – reported under Population: Community land and assets
- location of healthcare facilities and severance/separation of communities from such facilities – reported under Population: Community land and assets
- outline spatial characteristics of the transport network and usage in the area, including the surrounding road network, Public Rights of Way (including bridleways), cycle ways, non-designated public routes and public transport routes - PRoW reported under Population: Community land and assets
- information on relevant multi-modal transport services is provided within the Walking, Cycling & Horse-Riding Assessment and Review (WCHAR)-
- air quality management areas and ambient air quality – Local authority air quality Annual Status Reports, including locations of any AQMA within, or close to the border of the affected road network, will be reported in the Air Quality assessment of the ES.
- areas recognised as being sensitive to noise (e.g. noise important areas, noise management areas) and the ambient noise environment – Noise Important Areas within 1km of the route corridor are identified in Chapter 13: Noise and Vibration, and baseline noise conditions will be reported in the Noise and Vibration section of the ES.
- sources and pathways of potential pollution (e.g. land/water contamination) – reported in Chapter 10: Geology and Soils and Chapter 15: Road Drainage and the Water Environment (note that ground and water pollution is scoped out of the health assessment)

- landscape amenity – reported in Chapter 11: Landscape and Visual; and
- safety information associated with the existing affected road network (e.g. numbers of killed and seriously injured) will be obtained from the relevant local authorities.

14.5.7 Baseline information on the health of the communities within the study area will be used to establish a baseline for the assessment and to evaluate the sensitivity of the receptor communities. Information on health, social and economic indicators, as set out in *DMRB LA 112*, will be obtained from online sources including ONS data and English Indices of Multiple Deprivation (IMD). Information that is not available online, such as data on respiratory diseases, will be obtained from Public Health England.

14.5.8 Table 14-3 below provides a preliminary review of the health and social characteristics of the affected communities using information from online sources. Based on this information, a preliminary list of vulnerable groups to be considered within the human health assessment has been identified.

Table 14-3: Local baseline conditions – human health

Scheme	Baseline health profile
M6 Junction 40	This scheme is located in a semi-urban area on the southern outskirts of Penrith. Land uses close to the scheme include a business park, office buildings, a hotel and a farmers' market. The nearest residential area is on Clifford Road, more than 100m from the scheme on the far side of the North Lakes Hotel and Spa. This section of the route passes through Lower Layer Super Output Areas (LSOAs) Eden 003D and Eden 004G. 18.2% of the combined population of these areas is under 16 years old (in line with the national average). 20.2% of the combined population of these areas is over 65 years old (above the national average). 14.2% of the combined population of these areas lives with disabilities or long-term health problems (lower than the national average). The area of Eden 003D is ranked within the 50% least deprived areas in England (ie close to the national average) when measured as an average across all indices in the Index of Multiple Deprivation (IMD). It is in: • the 50% least deprived areas in for employment • the 40% most deprived areas for health and disability • the 50% least deprived areas for living environment The area of Eden 004G is ranked within the 20% least deprived areas in England when measured as an average across all indices of the IMD. It is in: • the 40% least deprived areas in for employment • the 20% most deprived areas for health and disability • the 20% least deprived areas for living environment The average life expectancy in Eden District is 80.9 years for males (above the national average) and 84.8 years for females (above the national average). Based on overall health indicators and life expectancy, the local population has below average sensitivity to adverse health effects. Key vulnerabilities include a relatively high proportion of older people within the community.

Scheme	Baseline health profile
M6 Junction 40 to Kemplay Bank Roundabout	This scheme is located in a semi-urban area on the southern outskirts of Penrith. Land uses in proximity to the scheme include residential neighbourhoods along Clifford Road and Pategill Road, a primary school, hospital, churches, sports and recreational facilities. This section of the route passes through LSOAs Eden 004G and Eden 003B. 15.8% of the combined population of these areas is under 16 years old (below the national average). 29.1% of the combined population of these areas is over 65 years old (above the national average).17.4% of the combined population of these areas lives with disabilities or long-term health problems (in line with the national average). The area of Eden 004G is ranked within the 20% least deprived areas in England when measured as an average across all indices of the IMD. It is in: • 40% least deprived areas in for employment • the 20% most deprived areas for health and disability • the 30% least deprived areas for living environment The area of Eden 003B is ranked within the 40% most deprived areas in England measured as an average across all indices of the IMD. It is in: • the 30% most deprived areas for employment • the 30% most deprived areas for health and disability • the 10% least deprived for living environment The average life expectancy in Eden District is 80.9 years for males (above the national average) and 84.8 years for females (above the national average). Based on overall health indicators and life expectancy, the local population has above average sensitivity to adverse health effects. Key vulnerabilities include areas of relatively high income and health deprivation on the southern outskirts of Penrith and a relatively high proportion of older people within the community.
Penrith to Temple Sowerby (Center Parcs)	This scheme runs through sparsely populated agricultural land with scattered houses and farmsteads. There are some recreational areas within 200m of the scheme including a park, recreation ground, and publicly accessible woodland. This section of the route passes through LSOA Eden 006D. 19.6% of the population in this area is under 16 years old (in line with the national average). 16.4% of the population in this area is over 65 years old (in line with the national average). 13.5% of the population in this area lived with disabilities or long-term health problems (below the national average). The area of Eden 006D is ranked within the 40% least deprived areas in England when measured as an average across all indices of the IMD. It is in: • the 10% least deprived areas for employment • the 10% least deprived areas for health and disability • the 10% most deprived for living environment

Scheme	Baseline health profile
	The average life expectancy in Eden District is 80.9 years for males (above the national average)and 84.8 years for females (above the national average). Based on overall health indicators and life expectancy, the local study population has below average sensitivity to adverse health effects. Key vulnerabilities include a relatively high deprivation ranking for living environment (a measurement of the quality of the indoor and outdoor local environment).
Temple Sowerby to Appleby	This scheme runs from east of Temple Sowerby, past the village of Kirkby Thore. The village lies to the south of the proposed bypass, on the line of the existing A66. The northern part of the village, including a primary school and church, are in proximity to the scheme. The A66 then runs mainly through sparsely populated agricultural land with scattered houses and farmsteads, passing approximately 500m north of the village of Crackenthorpe. The village of Appleby-in-Westmorland lies at the eastern extent of Scheme 5, with a secondary school and sports centre approximately 200m from the scheme. This section of the route passes through LSOA Eden 006D and Eden 006E. 18% of the combined population of these areas is below 16 years old (in line with the national average). 19.5% of the combined population of these areas is above 65 years old (above the national average). 13.7% of the combined population of these areas lives with disabilities or long-term health problems (below the national average). The area of Eden 006D is ranked within the 40% least deprived areas in England when measured as an average across all indices of the IMD. It is in: • the 10% least deprived areas for employment • the 10% least deprived areas for health and disability • the 10% most deprived for living environment The area of Eden 006E is ranked within the 40% least deprived areas in England when measured as an average across all indices of the IMD. It is in: • the 10% least deprived areas for employment • the 20% least deprived for health and disability • the 10% most deprived for living environment The average life expectancy in Eden District is 80.9 years for males (above the national average) and 84.8 years for females (above the national average). Based on overall health indicators and life expectancy, the local population has below average sensitivity to adverse health effects. Key vulnerabilities include a relatively high deprivation ranking for living environment and a relatively high proportion of older people in the community.
Appleby to Brough (Warcop)	This scheme runs through sparsely populated agricultural land with scattered houses and farmsteads. The village of Sandford lies approximately 800m south of the A66. The village of Warcop lies approximately 300m to the southeast. Warcop Training Camp lies to the

Scheme	Baseline health profile
	north of the village, around 100m from the indicative DCO boundary. The village of Brough is adjacent to a dualled section of the A66 and approximately 400m from the proposed dualling and embankment. This section of the route passes through LSOAs Eden 007E and Eden 007A. 16.5% of the combined population of these areas is below 16 years old (below the national average). 22.2% of the combined population of these areas is above 65 years old (above the national average). 14.3% of the combined population of these areas lives with disabilities or a long-term health problem (below the national average). The area of Eden 007E is ranked within the 40% most deprived areas in England when measured as an average across all indices of the IMD. It is in: • the 50% least deprived areas for employment • the 30% least deprived for health and disability • the 10% most deprived for living environment The average life expectancy in Eden District is 80.9 years for males (above the national average) and 84.8 years for females (above the national average). Based on overall health indicators and life expectancy, the local population has below average sensitivity to adverse health effects. Key vulnerabilities include a relatively high deprivation ranking for living environment and a relatively high proportion of older people in the community.
Bowes Bypass (A66/A67) and Cross Lanes to Rokeby	The Bowes Bypass runs immediately north of the village of Bowes, with houses and a primary school adjacent to the indicative DCO boundary. The church and village hall lie approximately 50m and 200m from the indicative DCO boundary. The Cross Lanes to Rokeby scheme runs through sparsely populated agricultural land with scattered houses and farmsteads. The village of Greta Bridge lies close to the eastern end of the scheme, with the nearest houses approximately 100m from the indicative DCO boundary. These sections of the route pass through LSOA County Durham 065B. 14.5% of the population in this area is below 16 years old (below the national average). 19.3% of the population in this area is above 65 years old (above the national average). 12.1% of the population in this area lives with disabilities or a long-term health problem (below the national average). The area of County Durham 065B is ranked within the 50% most deprived areas in England when measured as an average across all indices of the IMD. It is in: • the 20% least deprived areas for employment • the 30% least deprived areas for health and disability • the 10% most deprived for living environment The average life expectancy in County Durham is 78 years for males (below the national average) and 81.3 years for females (below the national average).

Scheme	Baseline health profile
	Based on overall health indicators and life expectancy, the local population has below average sensitivity to adverse health effects. Key vulnerabilities include a relatively high deprivation ranking for living environment and a relatively high proportion of older people in the community.
Stephen Bank to Carkin Moor	This scheme runs through sparsely populated agricultural land with scattered houses and farmsteads. The village of West Layton lies to the north, with a garden centre and hotel approximately 250m of the road and houses beyond. The village of Ravensworth lies approximately 1km south of the road. This section of the route passes through LSOAs Richmondshire 001C and Richmondshire 001F. 14.8% of the combined population of these areas is below 16 years old (below the national average). 20.8% of the combined population of these areas is above 65 years old (above the national average). 11.9% of the combined population of these areas lives with disabilities or long-term health problems (below the national average). The area of Richmondshire 001C is ranked within the 50% least deprived areas in England when measured as an average across all indices of the IMD. It is in: • the 30% least deprived areas for employment • the 20% least deprived areas for health deprivation and disability • the 20% most deprived areas for living environment The average life expectancy in Richmondshire is 81.2 years for males (above the national average) and 84.2 years for females (above the national average). Based on overall health indicators and life expectancy, the local population has below average sensitivity to adverse health effects. Key vulnerabilities include a relatively high deprivation ranking for living environment and a relatively high proportion of older people within the community.
A1(M) J53 Scotch Corner	This scheme is located in a sparsely populated agricultural area. The village of Middleton Tyas lies approximately 500m to the east, with housing extending along Middleton Tyas Lane in proximity to the motorway junction. This section of the route passes through LSOA Richmondshire 001E.14.7% of the population in this area is below 16 years old (below the national average). 32.3% of the population in this area is above 65 years old (above the national average). 14.3% of the population in this area lives with disabilities or long-term health problems (below the national average). The area of Richmondshire 001E is ranked within the 30% least deprived areas in England when measured as an average across all indices of the IMD. It is in: • the 30% least deprived for employment • the 20% least deprived for health and disability • the 20% most deprived for living environment

Scheme	Baseline health profile
	The average life expectancy in Richmondshire is 81.2 years for males (above the national average) and 84.2 years for females (above the national average). Based on overall health indicators and life expectancy, the local population has below average sensitivity to adverse health effects. Key vulnerabilities include a relatively high deprivation ranking for living environment and a relatively high proportion of older people within the community.

14.5.9 The following vulnerable groups are identified as being particularly relevant to the health assessment. This list is not exhaustive and additional groups may be identified during the course of the assessment:

- Families with children under 16
- People over the age of 65
- People on low incomes
- People living in areas of high deprivation
- People with long term illness or disability
- Residents in close proximity to proposed route
- Rural communities with low levels of access to services
- WCH

14.6 Potential impacts

Construction - population

14.6.1 Potential impacts relating to community land and facilities, local business and private property may include land-take, demolition and severance of access.

14.6.2 Potential impacts on agricultural businesses may include the severance of agricultural landholdings as well as disturbance and changes to access arrangements.

14.6.3 Potential impacts on development land may relate to impacts associated with temporary land-take.

14.6.4 Some WCH provisions (e.g. PRoW) and parcels of open access land will be temporarily severed during the construction phase. This may change the route which users of open access land and NMU take to access local facilities and use for recreational purposes, which will subsequently lead to a change in journey times.

Construction - human health

14.6.5 In accordance with *DMRB LA 112,* effects on health outcomes resulting from impacts on the following health determinants have been considered:

- environmental conditions relevant to human health, including:
  - ambient air quality
  - ambient noise
  - light pollution
  - odour
  - ground and water contamination
  - landscape amenity; and
- severance/accessibility and the ability of communities to access community land, assets and employment.

14.6.6 During the construction phase, local communities may be exposed to adverse effects on environmental conditions such as noise, dust, visual and lighting impacts and construction traffic (including HGVs). These impacts have the potential to adversely affect wellbeing by causing negative feelings such as stress and by deterring the use of outside space. Additionally, if night-time working is required, noise and lighting has the potential to cause sleep disturbance.

14.6.7 No potential construction impacts are identified in relation to the following environmental conditions included in *DMRB LA 112* and therefore these issues have been scoped out of the assessment:

- Soils and water contamination: the construction of the project will comply with legally required standards to prevent the emission of chemicals harmful to health to soils, surface water and groundwater, as described in Chapter 10: Geology and Soils and Chapter 15: Road Drainage and the Water Environment.
- Odour: there are no sources of odour associated with the construction of the project.

14.6.8 Increases in journey times resulting from traffic congestion or local road closures and diversions lasting for more than six weeks may have the potential to increase community severance. This could adversely affect wellbeing through temporary reductions in access to social networks, local neighbourhood centres, community services and facilities, open spaces and employment sites.

14.6.9 Temporary direct impacts on areas of public open space and PRoW during construction may impact on access to green space and reduce opportunities for physical activity.

14.6.10 There is a potential for mental and physical health effects resulting from the exposure of the population to impacts on environmental health determinants or changes in access and severance. Based on the nature of the project and the location of populated areas and sensitive receptors, such effects could potentially occur in the following areas during construction:

- M6 Junction 40 to Kemplay Bank Roundabout
- Temple Sowerby to Appleby
- Appleby to Brough (Warcop)
- Bowes Bypass (A66/A67)
- Stephen Bank to Carkin Moor

14.6.11 Health effects at the construction stage are scoped out for other areas because it is considered that the severity and extent of changes to health determinants is not sufficient to affect health outcomes, and/or there is no receptor population present.

14.6.12 At the routewide level, the construction phase will increase employment opportunities through the creation of direct construction jobs and increased demand for local suppliers and facilities such as shops and cafes. This has the potential to benefit the health and wellbeing of people throughout the study area, through improved earnings and opportunities for employment and training.

Operation - population

14.6.13 Permanent changes to the access of private assets may result in adverse and beneficial impacts on the accessibility of some private assets. There are likely to be associated beneficial impacts to private assets through improved accessibility.

14.6.14 During the operational phase there may be ongoing impacts on land access and access routes affecting agricultural businesses. There is the potential to permanently

change access to agricultural land and rural enterprises, which may benefit these businesses or adversely affect their functioning and viability.

14.6.15 The increased efficiency of operation of the road network may improve access to new employment opportunities and services.

14.6.16 Potential impacts on community land and facilities may include permanent changes to the accessibility of the asset. There are likely beneficial impacts to community land and facilities through improved accessibility.

14.6.17 New and improved crossing facilities are expected to improve connectivity, enhancing the permeability of the area. Any adverse impact on journey length on these affected PRoW in the long-term is consequently likely to be minimal.

Operation - human health

14.6.18 During the operational phase, residential properties and other sensitive receptors such as schools, community facilities and public spaces along new and existing sections of the route may experience permanent increases and decreases in exposure to traffic noise. This has the potential to give rise to adverse and beneficial effects on health and wellbeing, including levels of annoyance and sleep disturbance, and to affect the use and enjoyment of outside space.

14.6.19 The air quality chapter has identified potentially significant beneficial effects resulting from decreases in nitrogen oxide (NO_2) concentrations at locations along the existing A66 where traffic is diverted onto the new route further away from the receptors. No significant adverse effects on air quality are predicted, although some receptors will see small increases in exposure to NO_2. Therefore it is likely that there will be beneficial health effects at some locations associated with air quality.

14.6.20 The presence of new road infrastructure may result in adverse visual and lighting impacts at some locations. These impacts may adversely affect wellbeing by reducing the amenity of neighbourhoods.

14.6.21 No potential operational impacts are identified in relation to the following environmental conditions included in *DMRB LA 112* and therefore these issues have been scoped out of the assessment:

- Soils and water contamination: the design of the project will comply with legally required standards to prevent the emission of chemicals harmful to health to soils, surface water and groundwater, as described in Chapter 10: Geology and Soils and Chapter 15: Road Drainage and the Water Environment.
- Odour: there are no sources of odour associated with the operation of the project.

14.6.22 Reduced congestion along the A66 as a result of the Project will reduce journey times for local traffic and therefore has the potential to improve access for local communities to social networks, local neighbourhood centres, community services and facilities, open spaces and employment sites. This would have a beneficial effect on the wellbeing of the local population.

14.6.23 There is a potential for mental and physical health effects resulting from the exposure of communities to impacts on environmental health determinants or changes in access and severance. Based on the nature of the project and the location of populated areas and sensitive receptors, such effects will potentially occur in the following areas during operation:

- Temple Sowerby to Appleby
- Appleby to Brough (Warcop)
- Bowes Bypass (A66/A67)

14.6.24 Operational health effects are scoped out for other areas because it is considered that the severity and extent of changes to health determinants is not sufficient to affect health outcomes, and/or there is no receptor population present.

14.7 Design, mitigation and enhancement measures

14.7.1 The project will be designed to avoid and minimise any significant adverse impacts and effects that relate to population and health, as far as reasonably practicable. A number of design, mitigation and enhancement measures will be implemented by the contractor to reduce the impacts and effects that construction of the project would have in relation to population and health. This includes mitigation reported in Chapter 6: Air Quality; Chapter 10: Geology and Soils; Chapter 11: Landscape and Visual; Chapter 13: Noise and Vibration; and Chapter 15: Road Drainage and the Water Environment.

Design Intervention and Embedded Mitigation

14.7.2 In general the following mitigation hierarchy shall be implemented during design and assessment:

- Avoidance and prevention:
  - Identify alternative design/route options that avoid the requirement to compulsory purchase property, land and assets.
  - Identify alternative design/route options that avoid introducing or worsening severance and avoid reducing WCH provision/increasing journey times.
- Reduction:
  - Minimise impacts on property, land and assets by selecting route alignments that avoid land take from the most sensitive receptors/aspects of receptors thereby maintaining viability.
  - Refining alignment to minimise severance to communities and disruption to WCH provision.
- Mitigation and Enhancement:
  - Mitigation: incorporate mitigation into the project design, such as landscape planting, screening and noise barriers, to reduce as far as reasonably practicable the indirect impacts on residential areas and sensitive community receptors.
  - Remediation: where it is not possible to avoid or reduce a significant adverse effect, provide equivalent facilities as close to the original location as possible.
  - Enhancement: where mitigation results in an improved situation.

Construction - population

14.7.3 The Environmental Management Plan (EMP) will be prepared before any construction work commences. The starting point for the EMP will be the findings of the ES, including any mitigation identified or residual effects to be further addressed. It would outline an appropriate induction to be given to ensure contractors act considerately in relation to local residents and businesses, particularly for any works that may be programmed to take place at night, or in relation to the transportation of construction equipment or waste material, to reduce construction related nuisance.

14.7.4 The project would be developed to minimise the land required temporarily and permanently. The right to compensation and methods/procedures for assessing appropriate levels of such, would be undertaken in accordance with the Compensation Code. Appropriate consultation with landowners, occupiers and

agents would continue as the project develops to manage and reduce impact on property owners as far as practicably possible.

14.7.5 Local residents and businesses in close proximity to the project during construction may experience reductions in amenity from changes in air quality, visual amenity and noise. Detailed information relating to mitigation for these areas would be prepared in relation to individual topics.

14.7.6 Construction mitigation that may be necessary in relation to farm businesses may include:

- The reinstatement of land required on a temporary basis following construction.
- The accommodation of harvesting periods in the construction programme where possible to account for potential crop loss.
- Maintenance of farm access points where possible and reinstating these as soon as possible.
- Minimising impacts of dust and noise on crops and livestock.

14.7.7 To minimise disruption to WCH provisions, temporary diversions would be put in place where necessary, together with appropriate signage. This will be carried out in consultation with the local highways authority and other interested stakeholders.

14.7.8 Information about temporary closures and diversions will help to reduce inconvenience caused to users of PRoW.

Construction - human health

14.7.9 The EMP would set out the procedures to be followed to ensure that impacts from noise, dust, lighting and construction traffic are reduced as far as reasonably practicable, to minimise impacts on local communities. It would include specified working hours and construction traffic routes. Requirements for appropriate notifications and signage in relation to temporary road closures and diversions would be set out. The EMP would also include procedures for notifying local communities in advance of planned construction activities and a strategy for effective community liaison, including responding to any complaints.

Operation - population

14.7.10 Local residents and businesses (including agricultural holdings) in close proximity to the project may experience changes in amenity from changes in air quality, visual amenity and noise. Detailed information relating to mitigation for these areas will be prepared in relation to relevant topics.

14.7.11 Where possible the design will look to enhance the WCH network to improve connectivity and their recreational appeal. Likewise the design will investigate opportunities to increase accessibility to and from local agricultural land holdings, where appropriate.

Operation – human health

14.7.12 Communities in close proximity to the project may experience changes in amenity from changes in air quality, visual amenity (including lighting) and noise. Detailed information relating to mitigation for these areas will be prepared in relation to relevant topics.

14.8 Description of the likely significant effects

14.8.1 The likely significant effects identified in the Option Selection stage *EAR* are summarised below, and it is anticipated these could occur as a result of the project. This round of assessment will be undertaken without any scoping out, to ensure a robust appraisal of any likely significant residual effects.

Construction - Population

14.8.2 The project could result in temporary significant residual effects in the following ways, which are effects of moderate and above in line with DMRB , and is subject to further assessment within the Preliminary Environmental Information (PEI) Report and ES:

- Temporary diversion, severance or closure of WCH provisions
- Potential demolition or permanent land take of some private assets, local businesses and community land and facilities
- Impacts on agricultural businesses and the local economy through loss of agricultural production, severance of landholdings and, changes to access arrangements
- Temporary impacts on access to open space, natural assets and open access land

Construction - human health

14.8.3 Likely significant health effects associated with changes in environmental conditions include:

- Noise and visual impacts affecting residential areas, community land and facilities may reduce people's satisfaction with the quality of the local environment, giving rise to negative effects on mental wellbeing and changing behaviours such as participation in outdoor activities

14.8.4 Likely significant health effects associated with changes in environmental conditoins include:

- Temporary disruption of access to open space, community facilities, social networks and employment sites caused by road closures and diversions, resulting in temporary negative effects on mental and physical wellbeing.
- Construction employment, training, and impacts on local supply chains, resulting in positive mental and physical health outcomes associated with secure employment and increased incomes.

Operation - population

14.8.5 No significant residual effects upon population receptors are anticipated during operation.

Operation - human health

14.8.6 It is expected that significant health effects during operation will be mainly beneficial due to a reduction in traffic congestion and improved journey times. However, there may also be adverse effects resulting from changes in traffic flows and new exposure of receptors close to the alignment.

14.8.7 Likely significant health effects associated with changes in environmental conditions include:

- Effects on respiratory health due to changes in ambient air quality

- Effects on quality of life (annoyance) and sleep disturbance, physical and mental health due to changes in ambient noise
- Effects on quality of life and mental wellbeing resulting from changes to perceptions of the quality of neighbourhoods, due to the combined effects of noise, air quality, visual and lighting impacts

14.8.8 Likely significant health effects associated with changes in severance/accessibility and the ability of communities to access community land, assets and resources include:

- Effects on physical and mental health associated with access to green space, physical activity and social interaction
- Effects on physical and mental health associated with access to health services and other local services and facilities
- Effects on physical and mental health effects associated with income and employment status

14.9 Assessment methodology

Population

14.9.1 The population assessment will follow the approach set out in *DMRB LA 112*.

14.9.2 The value of each resource/receptor will vary due to a number of factors including but not limited to:

- The extent to which the resource/receptor is duplicated in the locality, with alternative provision available on a comparative basis
- The extent of the catchment area that is served by the resource / receptor and mode of access
- The proximity of the resource/receptor to the project
- The extent to which the operation of the resource/receptor will be impacted
- The extent to which the resource/receptor is central to/directly affects quality of life

14.9.3 The entire baseline will be updated within the PEI Report and ES. This will ensure the latest address data has been accounted for and up to date traffic count data have been used in the assessment in order to identify potential receptors. Gaps in the baseline reported in the Option Selection stage *EAR* will also be filled, through the following surveys and assessments:

- Community land and open space analysis
- Review of the Walking, Cycling Horse Riding Assessment and Review (WCHAR) survey data to identify the key WCH assets (any identified opportunities or enhancements)
- Agricultural land holding and business assessment

14.9.4 The value of the baseline receptors for population will be based upon Table 3.11 within *DMRB LA 112*.

14.9.5 The methodology for the assessment of effects on the receptors considered within the population assessment will comprise the following stages:

- Identify the importance (value) of receptors identified
- Determine the magnitude of impact with consideration of any embedded measures and additional mitigation
- The significance of effect is then derived by comparing the value of receptors with the magnitude of impact

14.9.6 The magnitude of impact will be based upon Table 3.12 within *DMRB LA 112* for private property and housing, community land and assets, development land and businesses, agricultural land holdings and WCH. The significance of effect will be based upon Table 3.8.1 within *DMRB LA 104* (see Table 5-1 in Chapter 5: Environmental Assessment Methodology of this ESR).

Human health

14.9.7 The human health assessment will follow the approach set out in *DMRB LA 112*.

14.9.8 Building on the information presented in Section 14.3, the demographic, social and health characteristics of the communities in the study area will be described. This will enable the health assessment to take account of the sensitivity of the population and to identify specific effects on vulnerable groups. The data will include:

- Prevalence of children and older people
- Prevalence of people with pre-existing health issues (e.g. respiratory disease/chronic obstructive pulmonary disease (COPD))
- Prevalence of people with long-term limiting illness or disability
- Levels of employment, income and deprivation
- General health indicators, including life expectancy

14.9.9 Data will be obtained from online sources, primarily:

- Office for National Statistics (Office for National Statistics, 2011)[209]
- *Public Health England Fingertips* (Public Health England Fingertips, 2020)[210]
- *Local Authority Health Profiles* (Government, 2019a)[211]
- *Nomis Official Labour Market Statistics* (Office of National Statistics, 2020)[212]
- *English Index of Multiple Deprivation* (Government, 2019b)[213]

14.9.10 Baseline data on residential property, community land and assets, and PRoW, will be sourced from the population baseline data as set out in Section 14.5 above. Baseline data relevant to health determinants, including Air Quality Management Areas (AQMA), noise sensitive areas and landscape designations will be sourced from the relevant EIA topic baselines.

14.9.11 Significant health effects will be identified through qualitative judgement of the likely effects on health outcomes for a defined receptor community. This will be based on:

- The nature, severity and geographic extent of an impact on a health determinant
- The size and sensitivity of the population exposed to the change, defined as low, medium or high and evidenced using the health baseline data
- Knowledge of associations between health determinants and health outcomes, based on published research

14.9.12 Judgements will be made on a case-by-case basis and a rationale will be provided within the assessment text. Health outcomes will be defined in accordance with *DMRB LA 112* (Table 3.32) as follows:

[209] Office for National Statistics (2011) Census data available at: https://www.ons.gov.uk/census/2011census.
[210] Public Health England Fingertips (2020) Public Health Profiles, available at: https://fingertips.phe.org.uk/
[211] Government (2019a) Local Authority Health Profiles: 2019), available at: https://www.gov.uk/government/statistics/local-authority-health-profiles-2019
[212] Office of National Statistics (2020) Nomis Official Labour Market Statistics
[213] Government (2019b) English indices of deprivation, available at: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019

- Positive – a beneficial health impact is identified
- Neutral – no discernible health impact is identified
- Negative – an adverse health impact is identified
- Uncertain – where uncertainty exists as to the overall health impact

14.10 Assessment assumptions and limitations

14.10.1 Baseline data will largely rely upon data from third parties. Therefore, the assessment within the ES will rely on the accuracy of this data.

14.10.2 Detailed construction methods have not yet been defined. Where required to inform the assessment on population, professional judgement has been used. It is anticipated that more detail will be available to inform the EIA, and reasonable worst-case assumptions will be used if required.

14.10.3 No site visits have been undertaken at this stage, and all findings are based upon desk-top research. Community land and open space surveys as well as a review of the WCHAR survey data from the Option Selection stage *EAR* will be required. This will confirm the severance and amenity value for WCH and also quantify the value of the community land and open space within the scheme study areas. Site visits for open spaces are unlikely to be possible based on prevailing government guidance.

14.10.4 No detailed consultation has been undertaken with business owners or landowners at this stage. However, these will be surveyed in advance of the final assessment.

14.10.5 There is no widely accepted definition of a significant health effect.The health assessment will be based on qualitative professional judgements of likely significant health effects, taking into account the nature and scale of impacts on health determinants and the sensitivity of the receptor population.

Table 14-4: Population and human health criteria from *DMRB LA 112* - construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
None specified in *DMRB LA 112*. Therefore: Is the project likely to result in a significant effect upon population and human health during construction?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Key Mitigation	**Population** The project would be developed to minimise the land required temporarily and permanently. The right to compensation and methods / procedures for assessing appropriate levels of such, would be undertaken in accordance with the Compensation Code. Construction mitigation that may be necessary in relation to farm businesses may include: The reinstatement of land required on a temporary basis following construction. The accommodation of harvesting periods in the construction programme where possible to account for potential crop loss. Maintenance of farm access points where possible and reinstating these as soon as possible. Minimising impacts of dust and noise on crops and livestock. To minimise the severance of access to community, residential and business receptors, WCH provisions and NMU routes, temporary diversions would be put in place where necessary, together with appropriate signage. This will be carried out in consultation with the local highways authority and other interested stakeholders. **Human health** The EMP would be prepared before any construction work commences and would outline an appropriate induction to be given to ensure contractors act considerately in relation to local residents and businesses, particularly for any works that may be programmed to take place at night, or in relation to the transportation of construction equipment or waste material. Detailed information would be prepared in relation to the control of noise, air quality and visual effects on local residents.									
Proposed Scope (In)	**Population**[214]	**Population**[213] **Human health**[215]	**Population**[213]	**Population**[213] **Human health**[214]	**Population**[213] **Human health**[214]	**Population**[213] **Human health**[214]	**Population**[213]	**Population**[213] **Human health**[214]	**Population**[213]	**Population**[213] **Human health**[216]
Proposed Scope (Out)	**Human health** The nature of the proposed works and its location in relation to residential areas and community facilities is not considered to	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment	**Human health** The scheme is located in a sparsely populated rural area and as such is not considered to adversely affect health.	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment	**Human health** The scheme is located in a sparsely populated rural area and as such is not considered to adversely affect health.	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment	**Human health** The nature of the proposed works and its location in relation to residential areas and community facilities is not considered to	**Population** **Human Health** Elements of the health assessment that can be scoped out will be determined following further assessment

[214] A full construction phase assessment has been scoped in as there is uncertainty as to whether or not the standard mitigation, which will be employed, is sufficient to prevent significant effects. Further assessment will be undertaken and presented in the Preliminary Environmental Information (PEI) Report.
[215] Qualitative assessment of health effects arising from impacts on residential areas and community facilities. Includes: impacts on environmental health determinants (noise, dust, visual and lighting, construction traffic) and impact on access to social networks, local neighbourhood centres, community services and facilities, open spaces and employment sites.
[216] Qualitative assessment of beneficial health effects associated with construction employment and training opportunities.

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
	give rise to health effects. It is assumed that construction traffic will access the site via the A66 /M6 and not via local roads. Skirsgill Park, to the south of the junction, is screened by vegetation and the scale of works is unlikely to deter use of the park. This will be reviewed at the assessment stage.	work, as part of the PEI Report.		work, as part of the PEI Report.	work, as part of the PEI Report.	work, as part of the PEI Report.		work, as part of the PEI Report.	give rise to health effects. It is assumed that construction traffic will access the site via the A66 / A1(M) and not via local roads.	work, as part of the PEI Report.

Table 14-5: Population and human health scoping criteria from *DMRB LA 112* - operation

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
None specified in *DMRB LA 112*. Therefore: Is the project likely to result in a significant effect upon population and human health during operation?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Key Mitigation	Population Residual significant effects upon population receptors are not expected if: where possible alternative alignment routes that avoid introducing or worsening severance for private properties and housing, community land and asset; and development land and businesses are utilised. Similarly, where possible the design will avoid reducing WCH provision/increasing journey times; or where avoidance is not possible the operational alignment is designed to minimise severance to any population receptors.									
Proposed Scope (In)	**Population**	**Population**	**Population**	**Population** **Human health** Qualitative assessment of health effects associated with changes in exposure to traffic noise, air emissions and visual/lighting impacts.	**Population** **Human health** Qualitative assessment of health effects associated with changes in exposure to traffic noise, air emissions and visual/lighting impacts.	**Population** **Human health** Qualitative assessment of health effects associated with changes in exposure to traffic noise, air emissions and visual/lighting impacts.	**Population**	**Population**	**Population**	**Population** **Human health** Qualitative assessment of health effects associated with changes in access to services and employment sites throughout the study area.
Proposed Scope (Out)	**Human health** The nature of the proposed scheme and its location in relation to residential areas and community facilities is not considered to give rise to health effects.	**Human health** The nature of the proposed scheme and its location in relation to residential areas and community facilities is not considered to give rise to health effects.	**Human health** The nature of the proposed scheme and its location in relation to residential areas and community facilities is not considered to give rise to health effects.	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment work, as part of the PEI Report.	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment work, as part of the PEI Report.	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment work, as part of the PEI Report.	**Human health** The scheme is located in a sparsely populated rural area and as such is not considered to adversely affect health.	**Human health** The scheme is located in a sparsely populated rural area and as such is not considered to adversely affect health.	**Human health** The nature of the proposed scheme and its location in relation to residential areas and community facilities is not considered to give rise to health effects.	**Human health** Elements of the health assessment that can be scoped out will be determined following further assessment work, as part of the PEI Report.

15 Road Drainage and the Water Environment

15.1 Introduction

15.1.1 This chapter outlines the proposed scope of assessment to be undertaken for road drainage and the water environment.

15.1.2 There may be associated potential effects related to road drainage and the water environment and other disciplines. Therefore, please refer to the following chapters:

- Chapter 7: Biodiversity
- Chapter 8: Climate
- Chapter 10: Geology and Soils

15.1.3 The methodology used will follow the requirements of *DMRB LA 113 Road Drainage and the Water Environment* (Highways England, 2020)[217] and *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)[218].

15.2 Key questions for scoping

1. Do you agree with the proposed scope of the road drainage and the water environment assessment outlined in this chapter?
2. Do you agree with the proposed study area and methodology for undertaking the road drainage and the water environment assessment outlined in this chapter? Are there any comments on the methodology you wish to raise?
3. Is there any additional baseline information or data that you wish to draw our attention to, or are able to provide us with to inform our assessments?
4. Are there any other key issues or aspects relevant to the road drainage and the water environment assessment that you wish to bring to the attention of the design and assessment team?
5. Are you happy to be contacted directly to discuss any aspects of your response to this scoping request? If so, we would be grateful if you could please include contact details in your response.

15.3 Study area

15.3.1 The study area will include surface water and groundwater features within a 1km radius of the indicative Development Consent Order (DCO) boundary and is based on the 'source-pathway-receptor' pollutant linkage principle. The 1km buffer was selected based on professional judgement of the potential impacts posed by the project and is in line with assessments for other highways schemes.

15.3.2 For direct effects on surface waters, the study area includes the geographical extent of the full scope of the works (including all of the alternative alignment routes and alternative junction arrangements being considered for each scheme as described in Chapter 2: The Project) and all surface water features, including main rivers and their tributaries, ordinary watercourses, surface water abstractions and flood zones within 1km, where features have hydrological connectivity to the project.

[217] Highways England (2020) Road drainage and the water environment LA 113, available at: https://www.standardsforhighways.co.uk/dmrb/search/d6388f5f-2694-4986-ac46-b17b62c21727
[218] Department for Transport (2014) National Policy Statement for National Networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

15.3.3 For groundwater, the study area includes the geographical extent of the full scope of the works and all groundwater features which include underlying aquifers, source protection zones, springs, groundwater abstractions and groundwater dependant terrestrial ecosystems (GWDTEs) within 1km of the project.

15.3.4 Extension of the study area beyond the 1km buffer may be necessary to capture potential impacts to receptors beyond the standard study area. This may be important where the project is likely to impact receptors upstream and downstream of the study area. A risk-based approach will be taken to the extension of the study area based on assessment of impact pathways and this will be kept under review as understanding of interactions evolves.

15.4 Overview of consultation to date

15.4.1 Table 15-1 identifies the key comments that have been received to date from external consultees on the scope and approach to the road drainage and the water environment assessment.

Table 15-1: Road Drainage and the Water Environment Comments to Date

Respondent	Comment	How addressed/to be addressed
Environment Agency, letter via email 18 December 2020	Lead Local Flood Authority (LLFA) should be consulted on surface water drainage. Surface water from new sections of road to discharge at the existing greenfield runoff rate.	The LLFAs will be consulted.
	Environment Agency welcome watercourse enhancements for otter, water vole and/or white-clawed crayfish, and should be consulted on any enhancement designs. Any new watercourse crossing should	Enhancements will be considered through the design development.
	aim to be clear span with abutments set back from the channel bank top. Culverts should be avoided where possible and only used where there is no other feasible alternative.	The measures outlined regarding watercourse crossings will be considered as part of the embedded design mitigation for the proposed scheme.
	Environment Agency would like to see culverts which may limit movement of wildlife upgraded and other wildlife crossing points included where possible.	
Environment Agency, letter via email 18 December 2020	Water receptors should be identified, and a desk based conceptual model should be produced detailing source – pathway – receptor linkages.	Water receptors will be identified by desk-based surveys and confirmed via site walkovers, with the information collected being used to inform the Environmental Statement

Respondent	Comment	How addressed/to be addressed
		(ES) chapter and its appendices.
	MoRPH River Condition Assessment information to understand baseline habitat value, should be used to evaluate impacts on hydromorphology and help develop mitigation. It will also be useful to feed into a Water Framework Directive (WFD) compliance assessment and Biodiversity Net Gain (BNG) assessment.	Impacts on hydromorphology will be reported within Chapter 15 Road Drainage and the Water Environment ES Chapter following the methodology outlined in *DMRB LA 113*. Details on the Habitats Regulations Assessments and BNG will be addressed within Chapter 7: Biodiversity. MoRPH River Condition Assessment will be used to capture the river condition of areas potentially impacted by the scheme and will be reported in the BNG assessment for ES Chapter 7: Biodiversity.
	A hydrogeological model should be produced and shared to stakeholders. If this is not possible, a worst-case scenario approach should provide a safety net. The worst-case approach should assume full connectivity between the groundwater and the ecosystem and would be relevant for migration of pollutants and the potential adverse impacts on groundwater flow, such as through dewatering activities.	A hydrogeological impact assessment including a conceptual groundwater model will be included as an appendix to Chapter 15: Road Drainage and the Water Environment ES Chapter.
	The latest advice on climate change allowance must be considered when producing the Flood Risk Assessment.	The latest climate change allowance will be used to inform the proposed schemes flood risk assessment, which will be included as an appendix to Chapter 15: Road Drainage and the Water Environment ES Chapter.
Environment Agency, letter via email 18	Where sections of the project are in close proximity to sensitive features (e.g. Special Area of Conservation (SAC), floodplains), these areas	This is noted. Flood risk modelling will consider the risks to the scheme and as a result of the scheme.

Respondent	Comment	How addressed/to be addressed
December 2020	should be minimise adverse impacts and to avoid exacerbating existing flooding issues or increase flooding elsewhere. Local knowledge and expertise from the different stakeholders will help inform these types of decisions.	Results will be presented as an appendix to the ES Chapter. Effort will be made to contact the Environment Agency, Lead Local Flood Authorities (LLFAs) and landowners with regards to understanding historic flooding and planned flood risk schemes.
	A water features survey should be undertaken as a priority to identify all surface water receptors in the area.	A water features survey will be conducted and be used to supplement desk-based information.
Natural England, letter dated 9th December 2020	The condition status of the River Eden SAC/SSSI could be affected in addition to the WFD status.	This is noted. Detailed change in status of designated features will be within ES Chapter 7: Biodiversity and its supporting appendices. A WFD compliance assessment will be conducted and reported on as an appendix to Chapter 15: Road Drainage and the Water Environment ES Chapter.
	Additional enhancements, such as Natural Flood Management measures should be considered. Also, potential to work with local landowners that will be directly affected by the scheme to improve management of drainage and surface water flows to prevent effluent and sediment reaching watercourses.	Additional enhancements will be developed; however, they will not form mitigation for the scheme.

15.5 Baseline conditions

15.5.1 The baseline describes the existing conditions and assigns sensitivity values to surface water, groundwater and flood risk receptors where possible at this stage. The following information sources have been used to complete the baseline assessment:

- Ordnance Survey (OS) *Open Data* (Ordnance Survey, 2020)[219]

[219] Ordnance Survey (2020) Open data maps, available at: https://www.bing.com/mapspreview

- Water Framework Directive (WFD) data, classifications and mitigation measures from the Environment Agency *Catchment Data Explorer* website (Environment Agency, 2020a)[220]
- Long term flood risk map for England (Environment Agency, 2020b)[221]
- British Geological Survey (BGS) *Onshore GeoIndex* (British Geological Survey, 2020b)[222]
- Designated sites from Natural England's MAGIC Map (Multi-Agency Geographic Information for the Countryside, 2020)[223]

15.5.2 Consultation with the Environment Agency and LLFAs was undertaken to inform the Option Selection stage Environmental Assessment Report (EAR) in spring 2018.

15.5.3 More detailed datasets such as abstractions and consented discharges to surface and groundwater from the Environment Agency along with any additional data received from the LLFA and water companies will be used to inform the Environmental Impact Assessment (EIA).

15.5.4 Several designated sites are within close proximity to the project along the route. Further detailed information for the respective designations is provided within Chapter 7: Biodiversity.

15.5.5 GWDTEs will be assessed following identification of potential GWDTEs within the Biodiversity study area (see Chapter 7: Biodiversity) and the development of a conceptual hydrogeological model, which will demonstrate the interactions between the proposed scheme and groundwater. This assessment will be presented within the Road Drainage and Water Environment ES chapter.

15.5.6 The key receptors are shown in Figure 15.1 in Chapter 18: Figures and summarised in Table 15-1. The flood zones and source protection areas are shown on Figure 15.1.

M6 Junction 40

15.5.7 This scheme comprises a junction improvement to the existing Junction 40 of the M6 roundabout. It lies within Eden District Council and Cumbria County Council boundaries.

Surface water

15.5.8 Within the study area the Main River, as designated by the Environment Agency, is the River Eamont, located in the south of the study area. The River Eden Special Area of Conservation (SAC) and the River Eden and Tributaries Site of Special Scientific Interest (SSSI) are within 250m of this scheme.

15.5.9 A number of smaller ordinary watercourses flow through the study area, with the River Eamont located 250m to the south of the existing roundabout at its closest point. Within Penrith, in the north of the study area, tributaries of the River Eamont including Dog Beck and Myers Beck flow west to east.

[220] Environment Agency (2020a) Catchment Data Explorer, available at: http://environment.data.gov.uk/catchment-planning/
[221] Environment Agency (2020b) Mapping, available at: http://apps.environment-agency.gov.uk/wiyby/default.aspx
[222] British Geological Survey (2020b) BGS Geoindex Onshore, available at: http://mapapps2.bgs.ac.uk/geoindex/home.html
[223] Multi-Agency Geographic Information for the Countryside (2020) Interactive Map, available at: https://magic.defra.gov.uk/magicmap.aspx

15.5.10 This study area is within the River Eamont Upper (GB102076071020) WFD surface waterbody catchment and and is associated with 'Good' ecological and 'Fail' chemical WFD status', resulting in a 'Moderate' overall status in 2019.

15.5.11 Highways England's Drainage Data Management System (HADDMS)[224] identifies four priority outfalls within the study area. One of these was classed as moderate priority (category C status), two as low priority (category D status) and one as risk addressed. No culverts, soakaways or flooding hotspots were identified within the study area on HADDMS. Information within HADDMS is known to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.12 BGS mapping shows that the scheme is underlain by bedrock of the Stainmore Formation, which is overlain by superficial deposits of Devensian till (diamicton).

15.5.13 This scheme is underlain by a Secondary A bedrock aquifer, defined as comprising of permeable layers capable of supporting water supplies at local rather than strategic scale, and a potential source of baseflow to rivers. The bedrock aquifer is overlain by Secondary A undifferentiated aquifer superficial deposits.

15.5.14 The study area is underlain by the Eden and Esk Lower Palaeozoic and Carboniferous Aquifers (GB40202G102300) WFD groundwater body; which achieved 'Good' quantitative and 'Poor' chemical WFD status', resulting in a 'Poor' overall status in 2019.

15.5.15 This scheme is not located within a Source Protection Zone (SPZ); however, there is a Total Catchment (Zone 3) Groundwater SPZ located 350m to the east of the scheme. These zones are defined by the Environment Agency with the aim of protecting sources of drinking water supply. Zone 3 is defined as the area around a source (e.g. well, borehole or spring) within which all groundwater recharge is presumed to discharge at the source.

Flood risk

15.5.16 The existing roundabout is located entirely within Flood Zone 1 (less than 1 in 1000 (0.1%)) annual probability of flooding from rivers and the sea). The River Eamont, to the south of the study area, and the watercourses within Penrith, to the north of the study area, are within Flood Zones 2 and 3. Flood Zones 2 and 3 are areas with a medium and high (between 1 in 100 and 1 in 1000 (1% - 0.1%) or 1 in 100 or greater (>1%)) annual probability of flooding from rivers and the sea respectively. Due to the distance from the sea, this is not considered to be a factor in the flood risk shown across the routes, and flood risk shown within Flood Zones 2 and 3 is considred to be a result of flooding from rivers (fluvial).

15.5.17 Small areas of surface water flooding (pluvial) is shown across the study area. This corresponds to topographical low points and watercourses across the study area. Several areas adjacent to the exisiting A66 at Skirsgill, sliproads to the north of Junction 40 and to the east of Junction 40 are shown to have a high risk of pluvial flooding.

[224] Highways England (2021) Highways England's Drainage Data Management System, available at http://haddms.com/

M6 Junction 40 to Kemplay Bank Roundabout

15.5.18 This scheme is located at the junction of the A66 with the M6, south of Penrith, extending to approximately 1km east of the M6 junction. It lies within Eden District Council and Cumbria County Council boundaries. The scheme is an underpass on the same alignment as the existing A66.

Surface water

15.5.19 Within the study area the Main Rivers, as designated by the Environment Agency, include the River Eamont, River Lowther and Thacka Beck. Ordinary watercourses within the study area include Myres Beck and Dog Beck. There are also a number of unnamed tributaries that flow north to south from Penrith into the River Eamont. The River Eamont and River Lowther are designated as part of the River Eden SAC and the River Eden and Tributaries SSSI.

15.5.20 River Eamont Upper (GB102076071020) WFD surface waterbody catchment underlies the majority of the study area. This waterbody is associated with a 'Good' Ecological and 'Fail' Chemical WFD status, resulting in a 'Moderate' overall status in 2019.

15.5.21 The Lowther (Lower) (GB102076071010) WFD catchment, to the south of the study area is associated with a 'Moderate' ecological and 'Fail' chemical WFD status, resulting in a 'Moderate' overall status in 2019.

15.5.22 No priority outfalls, culverts, soakaways or flooding hotspots were identified within the study area on HADDMS. Information within HADDMS is known to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.23 Due to this scheme including an underpass within a cutting, this scheme is likely to interact with groundwater, which will form a key part of the road drainage and the water environment considerations for this section.

15.5.24 BGS mapping shows that the scheme is underlain by bedrock of the Penrith Sandstone Formation, which is overlain by superficial deposits comprising predominantly of Devensian till (diamicton), with an area of Devensian glaciofluvial deposits (sand and gravel) between the M6 and the A6 roundabout.

15.5.25 The western section of the scheme is underlain by a Secondary A bedrock aquifer. The eastern section of the scheme is underlain by Principal bedrock aquifer; defined as layers of rock or drift deposits that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. The bedrock geology is overlain by Secondary A or Secondary A undifferentiated aquifer superficial deposits.

15.5.26 The study area is underlain by the WFD groundwater body Eden and Esk Lower Palaeozoic and Carboniferous Aquifers (GB40202G102300) to the west; which achieved a 'Good' quantitative and 'Poor' chemical WFD status, resulting in a 'Poor' overall status in 2019. Eden Valley and Carlisle Basin Permo-Triassic sandstone aquifers (GB40201G100400) is located to the east, which is associated with 'Good' quantitative and 'Poor' chemical WFD status, resulting in a 'Poor' overall status in 2019.

15.5.27 The majority of the study area is located within a Total Catchment (Zone 3) Groundwater Source Protection Zone (SPZ).

Flood risk

15.5.28 The majority of the study area is within Flood Zone 1. There is a small area shown at risk of fluvial flooding within Flood Zones 2 and 3 associated with Thacka Beck as it flows through the study area (partly through a culvert). A more extensive area within Flood Zones 2 and 3 associated with the River Eamont is situated to the south.

15.5.29 The Environment Agency has highlighted Eamont Bridge village, which is immediately south of the A66/M6 interchange, as having a history of flooding from the River Eamont. The Environment Agency are considering a flood alleviation scheme for the area.

15.5.30 There are areas of 'High' pluvial water flood risk associated with the Dog Beck and Thacka Beck within Penrith and adjacent to the existing A66. 'High' risk areas are contained to the adjacent parkland and a small area on the A686, in the west of the study area. In the west of the study area, Wetheriggs Country Park, adjacent to the existing A66, is shown to have a 'High' pluvial water flood risk.

Penrith to Temple Sowerby (Center Parcs)

15.5.31 The western extent of the scheme is located near the existing A66 River Eamont crossing and continues to Whinfell House in the east. It lies within Eden District Council and Cumbria County Council boundaries. The majority of the scheme is online, with an exception of a diversion to the south to avoid High Barn.

Surface water

15.5.32 The Main Rivers within the study area are the River Lowther, River Eamont and River Eden. Ordinary watercourses within the study area include Light Water and its tributaries, which flow into the River Eamont, and Swine Gill, which is a tributary of the River Eden. There are also several ponds, field drains and small unnamed watercourses within the study area.

15.5.33 The River Eden SAC and the River Eden and Tributaries Site of Special Scientific Interest (SSSI) are located within the study area.

15.5.34 This study area is within two WFD waterbody catchments, the River Eamont (Lower) (GB102076070990) to the west which is associated with a 'Good' Ecological and 'Fail' Chemical WFD status, resulting in a 'Good' overall status in 2019, and the Eden Lyvennet to Eamont (GB102076070980) to the east, which is associated with a 'Good' Ecological and 'Fail' Chemical WFD status, resulting in a 'Moderate' overall status in 2019.

15.5.35 The Lowther (Lower) (GB102076071010) is located in the south of the study area. This waterbody is associated with a 'Moderate' ecological and 'Fail' chemical WFD status, resulting in a 'Moderate' overall status in 2019.

15.5.36 HADDMS identifies 10 priority outfalls within the study area. Six classed as moderate priority (category C status) an dfour as low priority (category D status). No culverts, soakaways or flooding hotspots were identified within the study area on HADDMS. Information within HADDMS is known to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.37 BGS mapping shows that the scheme is underlain by bedrock of the Penrith Sandstone Formation, which is overlain by superficial deposits comprising of alluvium (clay, silt, sand and gravel) and Devensian till (diamicton).

15.5.38 The scheme is underlain by a Principal bedrock aquifer and the bedrock is overlain by Secondary A or Secondary undifferentiated aquifer superficial deposits.

15.5.39 This section of the study area is underlain by the Eden Valley and Carlisle Basin Permo-Triassic sandstone aquifers (GB40201G100400) WFD groundwater body; which is associated with a 'Good' quantitative and 'Poor' chemical WFD status, resulting in a 'Poor' overall status in 2019.

15.5.40 A Total Catchment (Zone 3) groundwater SPZ is located in close proximity to the western extent of the scheme. No further groundwater SPZ within the scheme's study area.

Flood risk

15.5.41 The majority of the study area is located within Flood Zone 1. There is an area of fluvial flood risk within the study area in Flood Zones 2 and 3 which associated with the River Eamont to the north of the scheme (no works are proposed within the floodplain at this location).

15.5.42 Light Water, a tributary of the River Eamont flows northwards under the A66 approximately 160m to the east of Llama Karma Kafe. Correspondence from Cumbria County Council indicates that there is historical fluvial flooding at this location, associated with the backing up of water upstream and south of the carriageway, overtopping the watercourse banks and inundating surrounding areas, with the potential to reach as far as the Llama Karma Kafe. Flooding from this watercourse is not shown on Environment Agency flood mapping.

15.5.43 There are areas of 'Medium' pluvial water flood risk associated with the River Eamont along the existing A66 and Moor Lane. There are areas of 'Low' pluvial water flood risk associated with the Light Water at Lightwater Bridge on along the existing A66 and the land adjacent to the south.

Temple Sowerby to Appleby

15.5.44 The alignment of this scheme, as included in the preferred route alignment, is offline to the north of Kirkby Thore in the west and then tracks offline along the Roman Road before diverting south to join the existing A66 to the west of Crackenthorpe. The scheme is located within Eden District Council and Cumbria County Council boundaries.

15.5.45 It should be noted that this scheme is currently subject to further alternative alignment routes assessment, in part due to the potential impacts associated with the crossing of Trout Beck (River Eden and Tributaries SAC). Alternative route alignments under consideration include crossing Trout Beck further to the east, further to the west (closer to Kirkby Thore) or a largely online route to the south of Kirkby Thore. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected route. The following section describes the baseline water features throughout the routewide study area where route alternatives are under consideration.

Surface water

15.5.46 The study area includes the Main Rivers of Trout Beck and the main channel of the River Eden. Both Main Rivers are within the designated areas of the River Eden SAC and the River Eden and Tributaries SSSI. The are also a number of smaller watercourses and field drains that flow through the study area and discharge into the River Eden or Trout Beck.

15.5.47 Three WFD catchments are located across the scheme, from west to east:

- Eden - Scandal Beck to Lyvennet (GB102076070880)
- Crowdundle Beck – Lower (GB102076070950)
- Trout Beck (GB102076070930)

15.5.48 All three catchments are associated with 'Good' ecological and 'Fail' chemical WFD status', resulting in a 'Moderate' overall status' in 2019.

15.5.49 During the earlier Option Selection stage, a bespoke survey combining River Habitat Survey (RHS), River Corridor Survey (RCS) and geomorphological methodologies was undertaken to inform the assessment of the effects of the options being considered upon the River Eden SAC and its qualifying features, in addition to the geomorphological regimes of the River Eden and Trout Beck. The surveys indicated that Trout Beck supports habitats and species which are included in the River Eden SAC designation. The River Eden also qualifies as a priority habitat (River S41 Habitat) and is therefore of very high habitat value.

15.5.50 Trout Beck has historically been realigned and meanders have been lost in the past century, thus reducing the wet channel length.

15.5.51 During consultation with the Environment Agency, water quality issues at the confluence of the Trout Beck and River Eden, to which road drainage may contribute, were highlighted.

15.5.52 HADDMS identifies 13 priority outfalls within the study area. 12 of these were classed as moderate priority (category C status) and one as low priority (category D status). Two culverts were also identified within the study area from HADDMS, in addition to two flooding hotspots, both of which were classed as 'risk addressed'. No soakaways were identified within the study area on HADDMS. Information within HADDMS is known to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.53 BGS mapping shows that the scheme is underlain by bedrock of the Penrith Sandstone Formation and the Eden Shales Formation which are overlain by superficial deposits comprising of alluvium (clay, silt, sand and gravel) and Devensian till (diamicton). The base of the Eden Shales Formation includes gypsum beds, which at Kirkby Thore overlie the Penrith Sandstone Formation. The contact between Penrith Sandstone Formation and Eden Shales Formation is locally faulted.

15.5.54 The majority of the study area is underlain by the Penrith Sandstone Formation Principal bedrock aquifer. The Eden Shales Formation is designated as Secondary B bedrock aquifer but designated as Unproductive where gypsum is present. The bedrock geology in proximity to the River Eden is overlain by Secondary A aquifer superficial deposits and Secondary undifferentiated aquifer superficial deposits elsewhere.

15.5.55 This section of the study area is underlain by the Eden Valley and Carlisle Basin Permo-Triassic sandstone aquifers (GB40201G100400) WFD groundwater body; which is associated with a 'Good' quantitative and 'Poor' chemical WFD status, resulting in a 'Poor' overall status in 2019.

15.5.56 There are no groundwater SPZ's within this section of the study area.

15.5.57 There are a number of gypsum mines within close proximity to the route, in the eastern sections. Although the alignment has been designed to avoid the mines, potential interactions with the water environment will be considered. At Kirkby Thore gypsum beds of the Eden Valley Shale Formation crop out at surface or are near

surface. At these locations the landscape includes natural enclosed depressions, reffered to as karst, which have developed from dissolution of the gypsum by rainfall.

Flood risk

15.5.58 The majority of the study area in this section is within Flood Zone 1. The existing A66 crosses the River Eden and its floodplain to the west of Temple Sowerby. To the south of Kirkby Thore there is a small area within Flood Zones 2 and 3 associated with fluvial flooding from Trout Beck (GB102076070850) (a tributary of the River Eden) where it flows from the eastern end of the study area towards Kirkby Thore. There is also a more extensive area within Flood Zones 2 and 3 associated with fluvial flooding from the River Eden and other smaller tributaries, including the Luz Beck, Palmer Gill and Hoff Beck, to the south of the route.

15.5.59 There are areas of 'High' pluvial water flood risk associated with tributaries of Trout Beck within Kirkby Thore along a number of residential roads as well as at the junction of Piper Lane and the exisitng A66. At Crackenthorpe, there is pluvial flood risk along the side road adjacent to the existing A66 and in the vicinity of the unnamed tributary to Trout Beck to the north of the settlement. There are also areas of 'High' pluvial flood risk associated with the River Eden along several residential roads within Appleby, including Drawbiggs Lane and the B6542.

15.5.60 There are areas of pluvial flood risk adjacent to both Trout Beck and the River Eden, likely indicating the historic flow paths for the respective channels. This is the case downstream of the realigned section of Trout Beck, where there are areas of 'High' pluvial flood risk parellel, to the north of the existing channel.

Appleby to Brough (Warcop)

15.5.61 This section is an approximately 7km stretch of largely online dualling. This scheme is also located within the Eden District Council and Cumbria County Council boundaries. As with the Temple Sowerby to Appleby section, this scheme is also subject to further alternative alignment routes assessment due to its close interaction with the North Pennines Area of Outstanding Natural Beauty (AONB). Alternative alignments immediately north of Warcop and an alternative tie-in further east along the existing A66 are under consideration. The process and outcome of this assessment will be set out in the ES, along with detailed baseline description for the selected route. The following section describes the baseline features throughout the routewide study area where route alternatives are under consideration.

Surface water

15.5.62 There are a number of waterbodies and associated foodplains within the study area. The watercourses designated as Main Rivers by the Environment Agency within the study area include Coupland Beck, River Eden, Mire Sike, Moor Beck, Hayber Beck, Crooks Beck and Lowgill Beck. The River Eden is within the the River Eden SAC and River Eden and Tributaries SSSI, However it is noted that other watercourses may provide supporting features for the designations.

15.5.63 Named watercourses within the study area include Hayber Beck and Moor Beck which flow south towards Crooks Beck and the River Eden. In addition to these there are a number of tributaries to the named watercourses.

15.5.64 The following surface water WFD catchments are located within the study area:

- Hilton Beck (ID: GB102076070770)
- Eden - Scandal Beck to Lyvennet (ID: GB102076070880)
- Low Gill (Crooks Beck) (ID: GB102076070750)

15.5.65 Hilton Beck is associated with a 'Good' ecological and 'Fail' chemical WFD status', resulting in a 'Moderate' overall status in 2019. The Eden - Scandal Beck to Lyvennet is associated with a 'Good' ecological and 'Fail' chemical WFD status', resulting in a 'Moderate' overall status in 2019. Low Gill (Crooks Beck) is associated with a 'Poor' ecological and 'Fail' chemical WFD status, resulting in a 'Poor' overall status in 2019. The Environment Agency lists diffuse pollution from poor nutrient management from argirculture (livestock) and sediment from agriculture and rural land management on fish as reasons for not achieving good status and reasons for deteriration for Low Gill (Crooks Beck).

15.5.66 HADDMS identifies 27 priority outfalls within the study area. 20 of these were classed as moderate priority (category C status) and seven as low priority (category D status). Six culverts were also identified within the study area from HADDMS. No soakaways or flooding hotspots were identified within the study area on HADDMS. Information within HADDMS is known to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.67 BGS mapping shows that the scheme is underlain by bedrock of the Penrith Sandstone Formation, which is overlain by superficial deposits comprising of alluvium (clay, silt, sand and gravel) and Devensian till (diamicton).

15.5.68 The scheme is underlain by Principal bedrock aquifers with Secondary B bedrock aquifers within the study area to the north. Secondary B aquifers are defined as predominantly lower permeability layers which may store and yield limited amounts of groundwater. The bedrock geology is overlain by Secondary A or Secondary undifferentiated aquifer superficial deposits.

15.5.69 This study area is underlain by the Eden Valley and Carlisle Basin Permo-Triassic sandstone aquifers (GB40201G100400) WFD groundwater body; which is associated with a 'Good' quantitative and 'Poor' chemical WFD status, resulting in a 'Poor' overall status in 2019.

15.5.70 There are no groundwater SPZ's within this section of the study area.

Flood risk

15.5.71 The majority of the study area is within Flood Zone 1. A morphologically and topographically complex floodplain area, due to road and railway line embankments and watercourse crossings associated with the Hayber Beck and Moor Beck, is located in the centre of the study area, to the north of Warcop. A narrow strip of the study area is within Flood Zones 2 and 3, associated with fluvial flooding from Mire Sike and Cringle Beck, is located alongside the Eden Valley Railway to the north of Warcop. Further areas within the Flood Zones 2 and 3 are located between Warcop and Sandford and are asscіated with fluvial flooding from Crooks Beck and the River Eden. Areas adjacent to Lowgill Beck and Woodend Sike are also within Flood Zones 2 and 3 due to fluvial flooding.

15.5.72 The Environment Agency has highlighted that Appleby (to the west of the scheme) has a considerable history of fluvial flooding from the River Eden. Existing flood defences in the town were overtopped in December 2015 and the Environment Agency are currently appraising and designing a flood alleviation scheme for the town. The village of Warcop is also vulnerable to fluvial flooding from the Lowgill Beck and Crooks Beck. Tributaries of Crooks Beck including Moor Beck and Hayber Beck are crossed by the scheme and the Environment Agency have advised that the existing A66 has a history of fluvial flooding, particularly from Hayber Beck.

15.5.73 The Environment Agency has provided a hydraulic model of the Hayber Beck at Warcop which includes several tributaries of the River Eden. The model will be further developed to assess the scheme and results will be reported within the FRA which will accompany the ES Chapter.

Bowes Bypass (A66/A67)

15.5.74 This is a section of online dualling to the north of the town of Bowes. This scheme is within the Durham County Council boundary.

Surface water

15.5.75 The River Greta, a designated Main River, is located to the south of Bowes and a number of its associated unnamed tributaries are located within the study area.

15.5.76 The majority of the study area is within the Greta from Sleightholme Beck to Eller Beck (GB103025072140) WFD catchment. This waterbody is associated with a 'Moderate' ecological and 'Fail' chemical WFD status, resulting in a 'Moderate' overall status in 2019

15.5.77 In the northern extent of the study area, Deepdale Beck from source to River Tees (GB103025072170) and Tees from Percy Beck to River Greta (GB103025072512) both of which are associated with 'Good' ecological and 'Fail' chemical WFD status', resulting in a 'Moderate' overall status' in 2019.

15.5.78 HADDMS identifies two culverts and four flooding hotspots. Of the four flooding hotspots one was classed as very high prioty (category A status), two as high prioty (category B status) and one as moderate priority (category C status). No outfalls or soakaways were identified within the study area on HADDMS. Information within HADDMS is known to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.79 BGS mapping shows that the north, west and central regions of the study area are underlain by bedrock of the Stainmore Formation (mudstone, siltstone and sandstone), with the eastern regions of the study area underlain by bedrock of the Great Limestone Member (limestone) and the Alston Formation (limestone, sandstone, siltstone and mudstone). The bedrock is overlain by Devensian till (diamicton) superficial deposits across the majority of the study area. Areas of Devensian Glaciofluvial River Terrace Deposits (sand and gravel) superficial deposits are located adjacent to the River Greta, to the south of the study area.

15.5.80 The study area is underlain by a Secondary A bedrock aquifer. The bedrock geology is overlain by Secondary undifferentiated aquifer superficial deposits.

15.5.81 The study area is underlain by the Tees Carb Limestone and Millstone Grit (GB40302G700300) WFD groundwater body, which is associated with a 'Good' quantitative and 'Poor' chemical WFD status, resulting in a 'Poor' overall status in 2019.

15.5.82 The Great Limestone Member (limestone) is associated locally with karst landforms, including caves, and has potential to contribute groundwater to surface water via springs.

15.5.83 There are no groundwater SPZs within the study area

Flood risk

15.5.84 The majoority study area is within Flood Zone 1. There are areas within Flood Zones 2 and 3 associated with fluvial flooding from the River Greta within the study area approximately 500m south of the existing A66, however there is not considered to be any interaction with the scheme and Flood Zones 2 and 3.

Cross Lanes to Rokeby

15.5.85 This scheme is mostly online with the exception of a diversion to the south near to St Mary's Church. The exisiting A66 is on a ridgeline with Manyfold Beck to the north and Tutta Beck to the south, Smallways Beck is crossed by existing A66. This scheme is within County Durham County Council boundary.

15.5.86 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The following section describes the baseline water features throughout the routewide study area where route alternatives are under consideration.

Surface water

15.5.87 Within the study area the Main Rivers include the River Tees to the north and the River Greta to the east. Ordinary watercourses include Tutta Beck which flows west to east and is within 100m of the existing A66 at its closest point.

15.5.88 There are no designated areas within the study area related to the water environment.

15.5.89 The scheme is located on the boundary between WFD two catchments, the Tees from Percy Beck to River Greta (GB103025072512) to the north and the Greta from Gill Beck to River Tees (GB103025072130) to the south. Both WFD catchments are associated with 'Good' ecological status' and 'Fail' in chemical status' in 2019, resulting in overall status' of 'Moderate'.

15.5.90 HADDMS idenfiies one soakaway of 'undetermined' status and one flooding hotspot, which was classed as high prioty (category B status) within the study area. No priority outfalls or culverts were identified within the study area on HADDMS. Information within HADDMS is known to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.91 BGS mapping shows the study area is underlain by a bedrock of the Great Limestone Member (limestone), Alston Formation (sandstone) parallel to the scheme to the south and Stainmore Formation (mudstone, siltstone and sandstone) parallel to the scheme to the north. Across the majority of the study area, the bedrock is overlain by Devensian till (diamicton) superficial deposits. Areas of Alluvium (clay, silt, sand and gravel) superficial deposits are located adjacent to Tutta Beck, to the south, and Manyfold Beck, to the north of the study area.

15.5.92 According to Environment Agency online mapping, the area is underlain by a Secondary A bedrock aquifer. The bedrock geology is overlain by Secondary undifferentiated aquifer superficial deposits.

15.5.93 The study area is underlain by the Tees Carb Limestone and Millstone Grit (GB40302G700300) WFD groundwater body; which is associated with a 'Good' quantitative and 'Poor' chemical WFD status, resulting in a 'Poor' overall status in 2019.

15.5.94 The Great Limestone Member (limestone) is associated locally with karst landforms, including caves, and has potential to contribute groundwater to surface water via springs.

15.5.95 There are no groundwater SPZ within the study area.

Flood risk

15.5.96 The majority of the study area in this section is within Flood Zone 1. There is a small area of Flood Zones 2 and 3 within the woodland associated with the Tutta Beck to the south of the scheme, however there is not considered to be any interaction with the scheme and Flood Zones 2 and 3.

15.5.97 In the south-east of the study area there are areas of 'High' pluvial water flood risk associated with the Tutta Beck south along the existing A66. In the north and central sections of the study area there are areas of 'High' pluvial water flood risk associated with the Manyfold Beck along the existing A66.

Stephen Bank to Carkin Moor

15.5.98 This section is a 4-mile stretch of dualling with an offline section to the north. The line of the road is relatively straight and rises and falls through undulations in the landscape. This scheme is within Richmondshire District Council and North Yorkshire County Council boundaries.

15.5.99 It should be noted that this scheme is currently subject to further alternative alignment routes assessment. The following section describes the baseline water features throughout the routewide study area where route alternatives are under consideration.

Surface water

15.5.100 There are a number of ordinary watercourses within the study area. These predominatly flow south and include Mains Gill and unnamed tributaries to Holme Beck, in the west of the study area.

15.5.101 There are no designated areas within the study area related to the water environment.

15.5.102 The scheme is within the Skeeby/Holme/Dalton Bk from Source to River Swale (GB104027069180) WFD surface water catchment. The waterbody is associated with a WFD status of 'Moderate' ecological and 'Fail' chemical WFD status, resulting in a 'Moderate' overall status in 2019.

15.5.103 This study area is located in the upper reaches of the Humber River Basin District, with adjacent catchments in close proximity to the north and west, comprising tributaries of Clow Beck within the Northumbria River Basin District.

15.5.104 HADDMS identifies 10 priority outfalls within the study area, all of which had undetermined' status. Three culverts were also identified within the study area from HADDMS. Three flooding hotspots were identified within the study area, two of which were classed as very high prioty (category A status) and one of high prioty (category B status). No soakaways were identified within the study area on HADDMS. Information within HADDMS is known to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.105 OS mapping indicates there are several springs and wells within close proximity to the western section of the route potentially indicating a high groundwater level within the study area. BGS records show a borehole record from 2014 at Mainsgill Farm to

the south of the existing A66 adjacent to Moor Lane which recorded a water level of 9.5m below ground level.

15.5.106 BGS mapping shows the scheme is underlain by three bedrock types; the Four Fathom Limestone Member (limestone), the Alston Formation (sandstone) and the Alston Formation (limestone, sandstone, siltstone and mudstone). Across the majority of the study area, the bedrock is overlain by Devensian till (diamicton) superficial deposits. Areas of Devensian Glaciofluvial Sheet Deposits (sand and gravel) are shown to be present within the study to the south of the existing A66 at Fox Hall Inn, and Alluvium (clay, silt, sand and gravel) is present to the south of the scheme at Stephen Bank.

15.5.107 According to Environment Agency online mapping, the area is underlain by a Secondary A bedrock aquifer. The bedrock geology is overlain by Secondary undifferentiated aquifer superficial deposits.

15.5.108 The study area is underlain by SUNO Millstone Grit and Carboniferous Limestone (GB40402G701900) and Tees Carb Limestone and Millstone Grit (GB40302G700300) WFD groundwater bodies. Both are associated with 'Good' quantitative and 'Poor' chemical WFD status', resulting in a 'Poor' overall status' in 2019.

15.5.109 There are no groundwater SPZ within the study area

Flood risk

15.5.110 The study area in this section is within Flood Zone 1. Small areas of fluvial flooding within Flood Zones 2 and 3 associated with Browson Beck encroach into the study area, however there is not considred to be any interaction with the scheme and Flood Zones 2 and 3.

15.5.111 In the centre of the study area there are areas of 'High' pluvial water flood risk associated with the tributary to Holme Beck located south of and crossing under the existing A66 and in the east of the study area there are areas of 'High' pluvial water flood risk associated with an unnamed watercourse at Mainsgill flowing underneath the existing A66. There are also a number of 'Low' pluvial water flood risk areas associated with a number of unnamed waterbodies located thoughout the study area.

A1(M) Junction 53 Scotch Corner

15.5.112 This section of the route is located at Junction 53 of the A1. It lies within the Richmondshire District Council and North Yorkshire County Council boundary.

Surface water

15.5.113 OS mapping indicates no surface watercourses or springs within close proximity.

15.5.114 There are no designated areas within the study area related to the water environment.

15.5.115 The study area is within Swale Middle operational catchment in the wider Humber River Basin District. The study area is within the Scorton Beck (GB104027069160) WFD surface waterbody catchment; which is associated with 'Poor' ecological and 'Fail' chemical WFD status, resulting in a 'Poor' overall status in 2019. The Environment Agency state that the 'Poor' ecological status is due to water industry, agriculture and rural land management activities within the catchment.

15.5.116 HADDMS identifies one flooding hotspot within the study area, which was classed as high prioty (category B status). No prioty outfalls, culverts or soakaways were identified within the study area on HADDMS. Information within HADDMS is known

to be incomplete across the scheme, and efforts will be made to inditify existing assets throughout the EIA.

Groundwater

15.5.117 BGS mapping shows the scheme is underlain by bedrock of the Four Fathom Limestone Member (limestone). Throughout the study area, this bedrock is overlain by Devensian till (diamicton) superficial deposits.

15.5.118 The area is underlain by a Secondary A bedrock aquifer. The bedrock geology is mostly overlain by Secondary undifferentiated aquifer deposits.

15.5.119 The study area is underlain by SUNO Millstone Grit and Carboniferous Limestone (GB40402G701900) WFD groundwater body; which is associated with 'Good' quantitative and 'Poor' chemical WFD status', resulting in a 'Poor' overall status' in 2019.

15.5.120 There are no groundwater SPZ within the study area.

Flood risk

15.5.121 The study area is within Flood Zone 1 with a 'Low' risk of fluvial flooding.

Provisional summary of receptors

15.5.122 The provisional importance assigned to the receptors in Table 15-2 has been determined with reference to Table 3.70 of *DMRB LA 113*, whereby importance is assigned based on the quality indicators of a receptor. Table 15-2 shows the key receptors identified at this stage of assessment.

Table 15-2: Value of Environmental Receptors – Road Drainage and the Water Environment

Scheme	Key Receptor	Provisional Importance[225]	Value Rationale	Location relative to scheme[226] (approximate)
M6 Junction 40	River Eamont	Very High	WFD classified watercourse River Eden and Tributaries SSSI River Eden SAC	250m south
	Secondary A bedrock	Medium	Capable of supporting water supplies	Underlying scheme
	Secondary A superficial deposits	Medium	Permeable layers capable of supporting water supplies at local scale	Underlying scheme
	Total Catchment GW SPZ (Zone 3)	Medium	As defined Table 3.70 of *DMRB LA 113*	350m west

[225] Importance is defined as 'provisional' as it may be updated when detailed assessment information is incorporated into the baseline
[226] Judged from nearest point based on freely available OS mapping

Scheme	Key Receptor	Provisional Importance[225]	Value Rationale	Location relative to scheme[226] (approximate)
M6 Junction 40 to Kemplay Bank Roundabout	River Eamont	Very High	WFD classified watercourse. River Eden and Tributaries SSSI. River Eden SAC.	320m south
	River Lowther	Very High	WFD classified watercourse. River Eden and Tributaries SSSI. River Eden SAC.	750m south
	Thacka Beck	Medium	Watercourse not classified under WFD	Crossed by scheme
	Secondary A bedrock	Medium	Capable of supporting water supplies.	Underlying scheme
	Principal Bedrock Aquifer	High	Principal aquifer providing locally important resource.	Underlying scheme
	Secondary A superficial deposits	Medium	Permeable layers capable of supporting water supplies at local scale.	Underlying scheme
	Total Catchment GW SPZ (Zone 3)	Medium	As defined Table 3.70 of *DMRB LA 113*.	Underlying the majority of the scheme
Penrith to Temple Sowerby (Center Parcs)	River Eamont	Very High	WFD classified watercourse. River Eden and Tributaries SSSI. River Eden SAC	Underlying the majority of the scheme
	River Lowther	Very High	WFD classified watercourse. River Eden and Tributaries SSSI. River Eden SAC.	100m west, parallel to the north of the scheme
	Light Water tributary to River Eamont	Medium	Watercourse not classified under WFD.	600m west
	Unnamed tributary to River Eamont	Medium	Watercourse not classified under WFD.	Crossed by scheme

Scheme	Key Receptor	Provisional Importance[225]	Value Rationale	Location relative to scheme[226] (approximate)
	Swine Gill tributary to River Eden	Medium	Watercourse not classified under WFD.	Crossed by scheme
	Principal Bedrock Aquifer	High	Principal aquifer providing locally important resource.	Crossed by scheme
	Secondary A superficial deposits	Medium	Permeable layers capable of supporting water supplies at local scale.	Underlying scheme
Temple Sowerby to Appleby	Trout Beck	Very High	WFD classified watercourse. River Eden and Tributaries SSSI. River Eden SAC.	Crossed by scheme
	River Eden	Very High	WFD classified watercourse. River Eden and Tributaries SSSI. River Eden SAC.	200m south
	Unnamed tributaries of the River Eden	Medium	Watercourses not classified under WFD.	Crossed by scheme
	Principal bedrock aquifer	High	Principal aquifer providing locally important resource.	Underlying scheme
	Secondary B bedrock aquifer	Low	Predominantly lower permeability layers which may store and yield limited amounts of groundwater.	Underlying scheme
	Unproductive	Low	Predominantly lower permeability layers which may store and yield limited amounts of groundwater.	Underlying scheme
	Secondary A superficial deposits	Medium	Permeable layers capable of supporting water supplies at local scale.	Underlying scheme
	Secondary (undifferentiated)	Medium	Permeable layers capable of supporting	Underlying scheme

Scheme	Key Receptor	Provisional Importance[225]	Value Rationale	Location relative to scheme[226] (approximate)
	superficial deposits		water supplies at local scale.	
Appleby to Brough (Warcop)	River Eden	Very High	WFD classified watercourse. River Eden and Tributaries SSSI. River Eden SAC.	600m south-west, parallel to the scheme
	Eden – Scandal Beck to Lyvennet	High	WFD Classified waterbody Not designated under SAC/SPA/Ramsar/SSSI.	Crossed by scheme
	Unnamed tributaries to River Eden	Medium	Watercourses not classified under WFD	Crossed by scheme
	Lowgill Beck	High	WFD classified watercourse. Assumed Q95 <1.0m3/s as precautionary approach.	Crossed by Scheme
	Tributaries of Crooks Beck, including Hayber Beck and Moor Beck	Medium	Watercourses not classified under WFD.	Crossed by scheme
	Principal bedrock aquifer	High	Principal aquifer providing locally important resource.	Underlying scheme
	Secondary B bedrock aquifer	Low	Predominantly lower permeability layers which may store and yield limited amounts of groundwater.	Underlying scheme
	Secondary A superficial deposits	Medium	Permeable layers capable of supporting water supplies at local scale.	Underlying scheme
	Secondary (undifferentiated) superficial deposits	Medium	Permeable layers capable of supporting water supplies at local scale.	Underlying scheme
	River Greta	High	Watercourse having a WFD classification.	500m south

Scheme	Key Receptor	Provisional Importance[225]	Value Rationale	Location relative to scheme[226] (approximate)
Bowes Bypass (A66/A67)			Not designated under SAC/SPA/Ramsar/SSSI	
	Tributaries of the River Greta	Medium	Watercourses not classified under WFD.	Within 50m south
	Secondary A bedrock	Medium	Capable of supporting water supplies.	Underlying scheme
	Secondary (undifferentiated) superficial deposits	Medium	Permeable layers capable of supporting water supplies at local scale.	Underlying scheme
Cross Lanes to Rokeby	Tees from Percy Beck to River Greta (northern catchment)	High	Watercourse having a WFD classification Not designated under SAC/SPA/Ramsar/SSSI.	520m north
	Tributaries of River Tees including Manyfold Beck	Medium	Watercourses not classified under WFD.	100m north
	Tributaries of the River Greta including Tutta Beck	Medium	Watercourses not classified under WFD.	100m south
	Secondary A bedrock	Medium	Capable of supporting water supplies.	Underlying scheme
Stephen Bank to Carkin Moor	Secondary (undifferentiated) superficial deposits	Medium	Permeable layers capable of supporting water supplies at local scale.	Underlying scheme
	Tributaries of Holme Beck	Medium	Capable of supporting water supplies.	Crossed by scheme
	Secondary A bedrock	Medium	Permeable layers capable of supporting water supplies at local scale.	Underlying scheme
A1(M) Junction 53 Scotch Corner	Secondary (undifferentiated) superficial deposits	Medium	Watercourses not classified under WFD.	Underlying scheme
	Secondary A bedrock	Medium	Capable of supporting water supplies.	Underlying scheme
	Secondary (undifferentiated)	Medium	Permeable layers capable of supporting	Underlying scheme

Scheme	Key Receptor	Provisional Importance[225]	Value Rationale	Location relative to scheme[226] (approximate)
	superficial deposits		water supplies at local scale.	

15.6 Potential impacts

15.6.1 The project has the potential to impact the water environment, including impacting on WFD status of connected watercourses and the condition status of the qualifying features of nearby designated sites (including the River Eden SAC/SSSI), during construction and operation.

Construction

15.6.2 During construction, significant potential impacts to surface water and groundwater features and flood risk could arise from:

- Increased pollution entering the watercourses from mobilised suspended solids and spillage of fuels or other harmful substances that may migrate to surface water and groundwater receptors.
- Impacts to the hydro-morphological and ecological quality of watercourses associated with works within or in close proximity to watercourses, including physical change to the watercourses and longer-term changes associated with sediment deposition.
- Impacts to local land drainage structures, that may alter existing drainage patterns within catchments and provide potential pathways for pollution.
- Impacts on local hydrogeology and groundwater resources. Changes to groundwater levels, flows and quality arising from construction activities, primarily dewatering; earthworks and intrusive investigation works creating new flow paths for groundwater particularly given the karst features which have been identified to underlie all schemes through a desk-based review. At this stage this is considered to pose a risk of significant potential impacts for all schemes, further groundwater level and ground condition investigations will inform the level of risk posed to respective schemes for the ES.

Operation

15.6.3 During operation, significant potential impacts to surface water features and groundwater features and flood risk could arise from:

- Polluted surface water runoff containing sediment, hydrocarbons and soluble pollutants, such as copper and zinc, that may migrate or be discharged to surface water features or groundwater resources via the proposed highway drainage system, including from spillages.
- Permanent impact to the hydro-morphological and ecological quality of water features associated with works within or in close proximity to water features.
- Permanent impacts to catchment hydrology and hydrogeology caused by the introduction of a barrier to natural overland flow e.g. introduction of embankments and changes to natural catchment dynamics associated with the proposed highway drainage system.
- Permanent impacts to catchment hydrology and hydrogeology caused by impact to natural groundwater springs or groundwater flow associated with proposed

road cuttings that could affect baseflow to watercourses and groundwater resources.
- Increased dissolution of gypsum bedrock from road drainage in the Kirkby Thore area of the Temple Sowerby to Appleby section where gypsum is present leading to potential ground instability.
- Increased rates and volumes of surface water runoff due to an increase in impermeable area or changes to the existing drainage regime leading to a potential increase in flood risk.
- Increased flood risk to the project and to people and property elsewhere caused by crossing of watercourses thus affecting flood flow conveyance and the potential loss of floodplain storage volume.
- Change in the rate of recharge of aquifers due to change in ground surface cover and introduction of new drainage systems.
- Reduced dilution and/or dispersion of consented discharges to groundwater and treated sewage effluent due to reduced or redirected groundwater flow paths.

15.7 Design, mitigation and enhancement measures

Construction

15.7.1 The Environmental Management Plan (EMP) will be produced and will include measures that are considered standard good practice to be implemented by the construction contractor to reduce the likelihood of impacts, or their magnitude if they were to occur. The EMP will include ground and surface water monitoring plans.

15.7.2 Standard measures to be included in the EMP will be based on the Environment Agency Pollution Prevention Guidelines (PPG) (withdrawn in 2015), subsequent guidance on GOV.UK, the relevant Construction Industry Research and Information Association (CIRIA) publications and good practice measures outlined in the PPG replacement series, Guidance for Pollution Prevention (GPP).

15.7.3 Examples of standard practice mitigation measures that will be included in the EMP include the provision of spill kits, restricting site traffic to dedicated haul roads and ensuring hard-standing areas are regularly swept and maintained.

15.7.4 Effective delivery of the measures set out in the EMP is to be monitored during the construction phase.

15.7.5 Works will be carried out in accordance with any approvals obtained pursuant to the DCO for the project in place of flood risk activity permits, ordinary watercourse consents or land drainage consents.

15.7.6 Further construction design and mitigation measures may include:

- A surface water management system using measures such as temporary silt fencing, cut off ditches, settlement ponds and bunds set up early in the construction period to capture all runoff and prevent ingress of sediments and contaminants into existing drainage ditches where necessary. This would be managed by the EMP in accordance with CIRIA Guidelines and the Environment Agency's approach to groundwater protection and groundwater protection guidelines.
- Water with a higher risk of contamination which requires discharge, including groundwater pumped out of pilings during concrete pouring, would be contained and treated using appropriate measures such as coagulation of sediments, dewatering and pH neutralisation prior to discharge. There are various proprietary package treatment plants available that can provide these measures.

- Contaminated water that cannot be treated on site would, if necessary, be pumped to a suitably licenced tanker before being exported off site for treatment at an appropriately permitted facility.
- A Flood Warning and Evacuation Plan will be developed where works are within areas potentially affected by flooding. This will set out the potential risks and identify a procedure for receiving and acting on flood warnings or for monitoring conditions on site to ensure that site operatives are aware of potential risks and how to mitigate them through safe working practices.
- Works would be suspended during out-of-bank river flows or during intense rainstorms.
- A suitable strategy will be developed for managing any temporary impacts on floodplain storage or conveyance which may include identifying specific areas outside the floodplain for storage of materials or providing compensatory storage on a temporary basis.
- Where watercourses are to be temporarily diverted to allow for the construction of the project, a suitable strategy will be developed to ensure that the detrimental impact on flows and floodplain utilisation is minimised.
- Water use efficiency measures will be adopted where applicable, for example rainwater harvesting and grey water re-use for wheel washing and dust suppression.
- Consideration of local groundwater catchment and flow regimes that may be affected by dewatering design and discharging the abstracted water to the same groundwater catchment and down gradient of the dewatered element.
- Discharge from dewatering activities such as earthworks, works within a floodplain or within eight metres of a watercourse will have a tailored risk assessment, consent and licences from the Environment Agency. Dewatering abstractions may also require transfer licenses from the Environment Agency.
- A surface water and groundwater monitoring plan will be developed and implemented be implemented where construction activities are considered to potentially effect surface water or groundwater receptors.

Operation

15.7.7 Operational measures may include:

- Surface water runoff from all additional areas of hardstanding will be managed using appropriate Sustainable Drainage Strategy (SuDS) both to attenuate runoff to agreed rates and to provide suitable treatment to control runoff quality. Discharges into watercourses that require consents or permits and the final strategy will adhere to the conditions of these.
- Attenuation/infiltration basins will be designed to ensure that groundwater levels would not impede their performance. In addition, where embankments are to be constructed above key groundwater/surface water interactions (springs), culverts or drainage blankets will be incorporated into the design to maintain the existing flow regime and to ensure the sub-surface flows do not compromise the integrity of the earthworks.
- Design of retaining walls or other structures within cuttings will incorporate drainage media, allowing seepages of groundwater from the exposed rock faces to be collected separately from the highway drainage and to allow recharge to the underlying aquifers, maintaining the existing recharge mechanisms. The recharge would occur either through the highway drainage or attenuation/infiltration basins. Where underlying geology prevents infiltration, collected groundwater would be discharged into the nearest surface

watercourse, which in baseline conditions would be recharged by that groundwater and thus maintaining the overall water balance within the catchments.

- The design of the road drainage network will consider necessary measures and treatment to provide appropriate protection to the karst aquifer from potential water quality deterioration. Where there is potential interaction with groundwater levels than these are appropriately assessed based upon the groundwater monitoring network.
- Any works impacting the floodplain (areas of Flood Zones 2 and 3) will be accompanied by a suitable floodplain compensation strategy to include measures to manage the impacts of loss of floodplain storage or conveyance.
- Any works within or alongside watercourses will be designed to ensure no significant detrimental impact on flow conveyance and no localised or catchment-wide impacts on flood risk; this will include any watercourse diversions, or any culverting required as a result of the permanent works.
- Any permanent watercourse diversions will be designed to ensure continuity of conveyance and floodplain utilisation such that there is no significant detrimental impact on the wider catchment.
- A Surface Water and Groundwater Monitoring Plan will be implemented if any permanent works could affect groundwater aquifers or groundwater dependant waterbodies or habitats.
- Mitigation measures will be agreed with the Environment Agency and LLFA to ensure compliance with their requirements.

Enhancement

15.7.8 Opportunities for enhancing the different aspects of the water environment shall be considered for the project.

15.7.9 The project will include road drainage that will capture pollutants within road runoff and remove pollutants before the treated runoff is discharged into surface water and groundwater features. Although considered embedded mitigation, the project looks to improve existing road drainage systems and will aim to improve the water quality of receiving surface water and groundwater. Where possible the project will seek to compliment other planned projects which have the aim of improving the water environment. Details will be sought through stakeholder engagement.

15.7.10 Where works around watercourses are proposed, the project will aim to incorporate biodiversity enhancements appropriate to the local context. Opportunities will be sought for structures within watercourses to be designed to improve flow conveyance and drainage systems to be designed to provide wider benefits and potentially reduce runoff into the receiving system where this may alleviate flooding downstream. This will be considered across the project, particularly around key receptors, such as the River Eden SAC and River Eden and its tributaries SSSI. This will be applied to all new watercourse crossings as mitigation, but opportunities will also be sought to identify locations where existing crossings can be improved (e.g. a number of culverts have been identified as being barriers to movement of species) within the indicative DCO boundary. There is therefore the potential to deliver enhancements over and above embedded mitigation.

15.8 Description of the likely significant effects

15.8.1 Most schemes within the project comprise changes to existing landcover, potentially resulting in changes to the runoff regime, groundwater levels and surface water and

groundwater quality. Receptors identified within the study area detailed within Section 15.3 and further to consideration of the baseline in section 15.5 have been scoped in for further assessment because they are potentially affected by the project. In the absence of suitable embedded design and mitigation measures, the project has the potential to result in detrimental effects on surface water and groundwater quality and quantity and on floodplain utilisation and floodplain extents. Further assessment will highlight key areas where mitigation is required to reduce the significance of effect.

15.9 Assessment methodology

15.9.1 The assessment will follow the standards of *DMRB LA 104 Environmental assessment and monitoring* and *DMRB LA 113*. These provide a methodology and criteria for assessing the impact of a proposed road scheme on the water environment. This standard methodology comprises the following steps:

- Identification of potential water receptors within the study area as per Table 3.69 of *DMRB LA 113*.
- Assessment of the potential importance, value and sensitivity of each of these receptors as per Table 3.70 of *DMRB LA 113*.
- Assessment of the potential magnitude of any construction or operation impact on the receptor as per Table 3.71 of *DMRB LA 113*.
- Assessment of the overall significance of any effects on receptors due to impacts, as per Table 3.8.1 of *DMRB LA 104*. The significance of effect is determined by a combination of the identified importance/sensitivity of the receptor with the estimated magnitude of the effect. Values of moderate adverse and above will be considered as significant potential effects.

15.9.2 The assessment will consider source – pathway – receptor linkages.

15.9.3 A standalone FRA will be prepared to support the EIA. It will assess potential impacts to the project and to people and property elsewhere associated with flood risk from all sources of flooding in accordance with NPPF. The FRA will include a quantitative assessment of flood risk for the scheme, including hydrological and hydraulic modelling. The FRA will be informed by consultation with the Environment Agency, relevant LLFAs and available published flood data. It will use the latest available climate change data.

15.9.4 The following additional assessments outlined in *DMRB LA 113* will be undertaken for the appropriate receptors within the study area:

- Surface water quality and routine runoff using Highways England Water Risk Assessment Tool (HEWRAT)
- Groundwater levels and flow (Appendix A of *DMRB LA 113*)
- Groundwater dependant terrestrial ecosystems (Appendix B of *DMRB LA 113*)
- Groundwater quality and run off (Appendix C of *DMRB LA 113*)
- Spillage assessment (Appendix D of *DMRB LA 113*)
- Hydro-morphological assessment (Appendix E of *DMRB LA 113*)

15.9.5 The construction and operation of the project has the potential to result in potential direct adverse effects on surface water and groundwater bodies classified under the WFD. Therefore, a WFD assessment will be undertaken to the appropriate level, with reference to the Planning Inspectorate (PINS) Advice Note 18 *The Water Framework Directive* (The Planning Inspectorate, 2017)[227] and in accordance with Environment

[227] The Planning Inspectorate (2017) Advice Note 18: The Water Framework Directive, available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf

Agency guidance (Environment Agency, 2017)[228] to determine whether the risk is acceptable. The WFD assessment will be informed by the additional assessments outlined in *DMRB LA 113*, as outlined in paragraph 15.9.3.

15.9.6 Due to the lack of information on baseline conditions for the project, site visits will be undertaken to enable sufficient data to be collected to inform the assessments. Discharge locations of highway drainage will be investigated and confirmed. Consultation with the Environment Agency and LLFA will continue during the assessment.

15.9.7 The legislation regarding flood compensation and WFD requires that proposed schemes do not lead to a significant adverse effect on the function and capacity of floodplains or the ecological or chemical status of a WFD designated watercourse. The project will therefore be designed in such a way as to avoid impacts, or impacts will be mitigated. In the unlikely event that mitigation is not possible, then the residual effects will be discussed in detail with relevant stakeholders to determine acceptability and compensation requirements.

15.9.8 It is not proposed that any water environment receptors outlined in the Chapter and shown in Table 15-2 are to be scoped out of the assessments at this stage, but this will be reviewed following the initial assessments which will inform the Preliminary Environmental Information (PEI) Report and discussed with stakeholders.

15.10 Assessment assumptions and limitations

15.10.1 The assessment of potential impacts is based on indicative project layout drawings, with decisions regarding the proposed design and mitigation not yet made. This is of particular importance when considering impacts associated with the quality of surface water runoff, impacts to hydromorphology and channel hydraulics, and the potential effects of the project relating to flood risk. Similarly, little is currently known regarding the existing and proposed drainage systems. This will be essential to the detailed assessment of risks associated with water quality and increased flood risk.

15.10.2 Historic flooding information provided in response to consultation with the Environment Agency and LLFAs to inform the Option Selection stage EAR in spring 2018 has been incorporated into the baseline for this assessment. More detailed datasets such as abstractions and consented discharges to surface and groundwater from the Environment Agency along with any additional data received from the LLFA and water companies will be used to inform the detailed assessment at the next stage.

15.10.3 Assessments conducted will be based upon the accuracy and assumptions of third-party data. Limitations and assumptions will be clearly set out in the assessment.

[228] Environment Agency (2016) Water Framework Directive assessment for a flood risk activity, available at: https://www.gov.uk/government/publications/water-framework-directive-how-to-assess-the-risk-of-your-activity

Table 15-3: Road Drainage and the water environment scoping criteria from *DMRB LA 113* - construction

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
a) does the project have the potential to affect an existing watercourse in terms of water quality, hydromorphology or water quantity?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
b) does the project have the potential to affect a floodplain?	N (Paragraph 15.5.16)	Y	Y	Y	Y	Y	Y	Y	N (Paragraph 15.5.119)	Y
c) does the project have the potential to cross an existing watercourse where upstream flooding is an existing problem or where there has been significant development in the upstream catchment since the crossing was built[229]?	N (Paragraph 15.5.16)	Y	Y	Y	Y	Y	Y	Y	N (Paragraph 15.5.119)	Y
d) does the project have the potential to change either the road drainage or natural land drainage catchments[230]?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
e) does the project have the potential to lead to an increase in traffic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[229] Scoped in if watercourse crossing is downstream of development
[230] Offline compounds / construction drainage

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
flow of more than 20%[231]?										
f) does the project have the potential to change the number or type of junctions[232]?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
g) is any of the project located within flood zone 2, flood zone 3 or a source protection zone?	N (Paragraph 15.5.14 and 15.5.15)	Y	Y	Y	Y	N (Paragraph 15.5.82 and 15.5.83)	N (Paragraph 15.5.94 and 15.5.95)	N (Paragraph 15.5.108 and 15.5.109)	N (Paragraph 15.5.118 and 15.5.119)	Y
h) can earthworks result in sediment being carried to watercourses[233]?	Y	Y	Y	Y	Y	Y	Y	Y	N (Paragraph 0)	Y
i) can earthworks alter the groundwater flow regime[234]?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
j) does the project have the potential to allow drainage discharges to the ground[235]?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Key Mitigation	None scheme specific	Specific groundwater treatment measures	Relevant consents in DCO (OWC, land drainage)	Relevant consents in DCO (FRAP, land drainage) Measures identified within HRA	Flood Warning and Evacuation Plan Relevant consents in DCO (FRAP, OWC, land drainage) Specific groundwater treatment measures	None scheme specific	Relevant consents in DCO (OWC, land drainage) Specific groundwater treatment measures	Relevant consents in DCO (FRAP, land drainage)	None scheme specific	EMP following standard good practice – PPG and GPP

[231] Applies to HEWRAT operational assessment.
[232] Applies to HEWRAT operational assessment
[233] Scoped in if watercourse crossing identified
[234] Yes for all - groundwater flow poorly understood
[235] Will need to be confirmed following desk based BGS mapping available to date is very coarse. Yes - precautionary

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
Proposed Scope (In)	Impacts on surface water quality and groundwater quantity & quality	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality and groundwater quantity & quality	Potential Scheme wide effects have been scoped in at this stage as a precautionary approach as potential linkages between schemes may arise throughout the assessment process.
Proposed Scope (Out)	Flood risk & impact Scheme in flood zone 1 and no surface watercourse crossings are identified therefore flood risk and impact on floodplain is scoped out. (Paragraph 15.5.15)								Flood risk & impact Scheme in flood zone 1 and no surface watercourse crossings are identified therefore flood risk and impact on floodplain is scoped out. (Paragraph 15.5.111) No surface watercourses have been identified in close proximity to the scheme. Potential construction impacts on surface water quality will be managed effectively through the EMP and is therefore scoped out. (Paragraph 15.5.104)	

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide

Table 15-4: Road Drainage and the Water Environment scoping criteria from *DMRB LA 113* – operation

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
a) does the project have the potential to affect an existing watercourse in terms of water quality, hydromorphology or water quantity?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
b) does the project have the potential to affect a floodplain?	N (Paragraph 15.5.15)	Y	Y	Y	Y	Y	Y	Y	N (Paragraph 15.5.120)	Y
c) does the project have the potential to cross an existing watercourse where upstream flooding is an existing problem or where there has been significant development in the upstream catchment since the crossing was built[236]?	N (Paragraph 15.5.15)	Y	Y	Y	Y	Y	Y	Y	N (Paragraph 15.5.120)	Y
d) does the project have the potential to change either the road drainage or natural land	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

[236] Scoped in if watercourse crossing is downstream of development

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
drainage catchments[237]?										
e) does the project have the potential to lead to an increase in traffic flow of more than 20%[238]?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
f) does the project have the potential to change the number or type of junctions[239]?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
g) is any of the project located within flood zone 2, flood zone 3 or a source protection zone?	N (Paragraph 15.5.14 and 15.5.15)	Y	Y	Y	Y	N (Paragraph 15.5.82 and 15.5.83)	N (Paragraph 15.5.94 and 15.5.95)	N (Paragraph 15.5.108 and 15.5.109)	N (Paragraph 15.5.118 and 15.5.119)	Y
h) can earthworks result in sediment being carried to watercourses[240]?	Y	Y	Y	Y	Y	Y	Y	Y	N (Paragraph 0)	Y
i) can earthworks alter the groundwater flow regime[241]?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
j) does the project have the potential to allow drainage discharges to the ground[242]?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Key Mitigation	None scheme specific	Floodplain compensation strategy Crossings designed to ensure no detrimental impact on flow	Floodplain compensation strategy Crossings designed to ensure no detrimental impact on flow	Floodplain compensation strategy Crossings designed to ensure no detrimental impact on flow	Flood Warning and Evacuation Plan Relevant consents in DCO (FRAP,	None scheme specific	Crossings designed to ensure no detrimental impact on flow conveyance and no localised or catchment-wide	Crossings designed to ensure no detrimental impact on flow conveyance and no localised or catchment-wide	None scheme specific	SuDS for attenuation and treatment to protect surface and groundwater quality Discharge consents

[237] Increased land take and new drainage all schemes
[238] Modelling indicates around 20% therefore YES - precautionary
[239] YES – precautionary. Detailed design not available but considered likely for all schemes
[240] Applies to construction assessment
[241] Yes for all - groundwater flow poorly understood
[242] Will need to be confirmed following Desk based BGS mapping available to date is very coarse. Yes - precautionary

	M6 Junction 40	M6 Junction 40 to Kemplay Bank Roundabout	Penrith to Temple Sowerby (Center Parcs)	Temple Sowerby to Appleby	Appleby to Brough (Warcop)	Bowes Bypass (A66/A67)	Cross Lanes to Rokeby	Stephen Bank to Carkin Moor	A1(M) J53 Scotch Corner	Routewide
		conveyance and no localised or catchment-wide impacts on flood risk	conveyance and no localised or catchment-wide impacts on flood risk	conveyance and no localised or catchment-wide impacts on flood risk	OWC, land drainage) Specific groundwater treatment measures		impacts on flood risk	impacts on flood risk		Groundwater drainage mechanisms to maintain water balance within catchment Surface water and groundwater monitoring plan to be agreed with EA
Proposed Scope (In)	Impacts on surface water quality and groundwater quantity & quality	Impacts on surface water quality, groundwater quantity & quality	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality, groundwater quantity & quality and flood risk	Impacts on surface water quality and groundwater quantity & quality	Potential Scheme wide effects have been scoped in at this stage as a precautionary approach as potential linkages between schemes may arise throughout the assessment process.
Proposed Scope (Out)	Flood risk & impact Scheme in flood zone 1 and no surface watercourse crossings are identified therefore flood risk and impact on floodplain is scoped out. (Paragraph 15.5.15)								Flood risk & impact Scheme in flood zone 1 and no surface watercourse crossings are identified therefore flood risk and impact on floodplain is scoped out. (Paragraph 15.5.111	

16 Assessment of Cumulative Effects

16.1 Introduction

16.1.1 This chapter sets out the scope of the cumulative effects assessment (CEA). The CEA will be undertaken following the guidance in *DMRB LA 104 Environmental Assessment and Monitoring* (Highways England, 2020)[243] and the advice in *Planning Inspectorate (PINS) Advice Note 17: Cumulative Effects Assessment (AN17)* (Planning Inspectorate, 2019)[244]. The CEA will also be informed by the *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)[245].

16.1.2 Two types of cumulative effects will be considered:

- Combined effects – the combined action of a number of different environmental topic-specific effects upon a single resource / receptor.
- Cumulative effects – the cumulative action of a number of different projects, together with the project being assessed, upon a single resource / receptor.

16.1.3 The project comprises nine individual schemes that will be delivered in four separate packages across a large geographic area. The packages are likely to be delivered to different timescales but with some overlap. This complexity means that it will be necessary for each environmental topic assessment to consider both the individual local effects of each scheme in isolation, and the cumulative effect of all the schemes, in order to demonstrate the environmental effects of the project have been fully assessed. Where applicable, this will be presented as a routewide assessment in the topic chapters of the ES, and is separate from and different to the cumulative effects assessment chapter.

16.2 Cumulative effects assessment methodology

Combined effects

16.2.1 Combined effects of the project will be assessed for receptors which could be affected by more than one environmental topic. An example of this type of effect would be where a local resident is affected by dust, noise and traffic disruption during construction, with the result being a greater level of nuisance experienced in combination than any of the individual effects in isolation.

16.2.2 The assessment will focus on the receptor and consider its capacity to accommodate the changes that are likely to occur because of the project. The significance of cumulative effects will be determined using the criteria in Table 3.7 of *DMRB LA 104*.

16.2.3 Effects from multiple schemes on a single receptor are not considered to be cumulative effects. Where a receptor is predicted to experience an effect or effects resulting from more than one scheme, the overall predicted effects of the project as a whole (i.e. considering effects arising from any of the schemes) on that receptor will be reported only once. This will be reported in the scheme within which the receptor

[243] Highways England (2020) Environmental Assessment and Monitoring LA 104, available at: https://www.standardsforhighways.co.uk/dmrb/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a
[244] Planning Inspectorate (2019) Advice Note 17, Cumulative Effects Assessment, available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf
[245] Department for Transport (2014) National Policy Statement for National Networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

is located (or if the receptor is located between schemes, within the scheme it is closest to).

Cumulative effects

16.2.4 Cumulative effects occur as a result of a number of other developments, which individually might not be significant, but when considered together could create a significant cumulative effect on a common receptor. This could include development separate from and/or related to the project itself.

16.2.5 *DMRB LA 104* states that the assessment of cumulative effects should report on:

- Roads projects which have been confirmed for delivery over a similar timeframe
- Other development projects with valid planning permissions or consent orders, and for which EIA is a requirement; and
- Proposals in adopted development plans with a clear identified programme for delivery.

16.2.6 *DMRB LA 104* states that the assessment of cumulative effects shall:

- Establish the zone of influence of the project together with other projects
- Establish a list of projects which have the potential to result in cumulative impacts; and
- Obtain further information and detail on the list of identified projects to support further assessment.

16.2.7 *DMRB LA 104* requirements are reflected in *AN17*, which sets out a four-stage approach that applicants are encouraged to adopt (see Figure 16-1).

16.2.8 The methodology in *AN17* is wider in its scope and application than DMRB in relation to the assessment of cumulative effects in EIA. The CEA will follow the broader approach outlined in *AN17* whilst incorporating the requirements of DMRB.

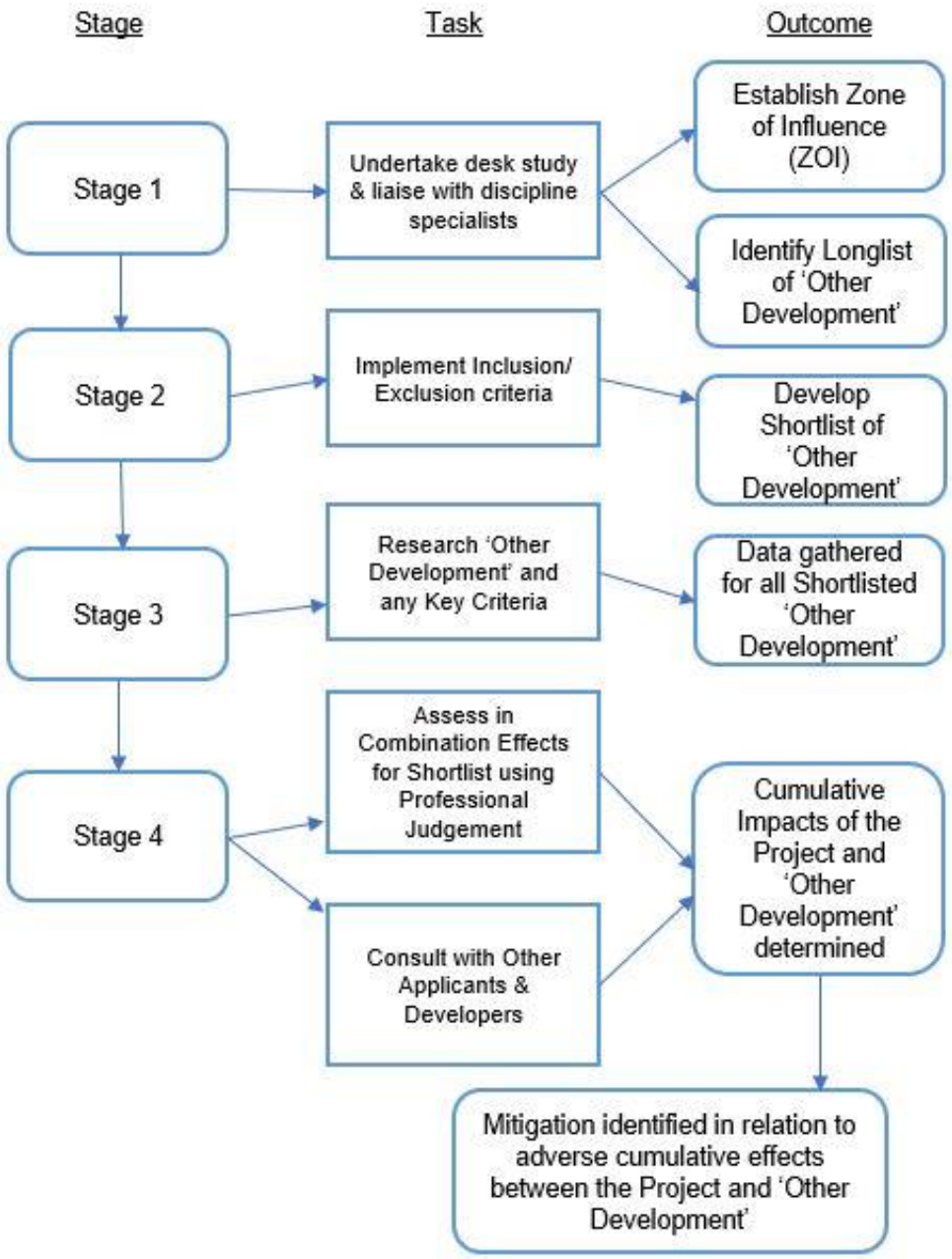


Figure 16-1: Flow Diagram Showing the Cumulative Effects Assessment Stages

16.2.9 Stage 1 of the CEA process involves establishing an appropriate Zone of Influence (ZOI) to help identify other development that may be relevant to the assessment. Initial ZOI have been established based on the study area of each topic in the EIA (see Table 16-1). The ZOI used for each topic will be different, and may evolve through further liaison with the Statutory Environmental Bodies (SEB) and technical specialists, Local Planning Authorities (LPA) and other consultees during the scoping process and beyond.

16.2.10 *AN17* also recommends that the ZOI for each aspect is mapped using GIS software. The ZOI presents a clear and justifiable area of search within which other existing development and/or approved development may be identified for assessment.

Table 16-1: Cumulative assessment initial zone of influence by topic

Environmental Topic	Initial Zone of Influence
Air Quality	**Construction**: The ZoI extends 200m from the 'affected road network'. **Operation**: The ZoI extends 200m from the 'affected road network'. As the operational phase traffic data includes traffic associated with other developments, the air quality impact assessment reported within Chapter 6 is inherently cumulative.
Noise and Vibration	**Construction**: The ZoI extends 200m from the 'affected road network'. **Operation**: The ZoI extends 200m from the 'affected road network'. As the operational phase traffic data includes traffic associated with other developments, the air quality impact assessment reported within Chapter 6 is inherently cumulative.
Landscape and Visual amenity	**Construction and Operation**: 2km from the centreline of the Scheme. Beyond this, any other development in combination with the Scheme would be unlikely to give rise to any significant effects on landscape or visual receptors due to the distance reducing the perceived scale and massing of the proposed built elements and associated operational elements (i.e. the traffic moving along the road); and the screening from intervening landform and vegetation.
Cultural Heritage	**Construction and Operation**: 1km from the Scheme boundary based on the sensitivity of features within the surrounding WHS and other designated assets. Professional judgement will be used to include assessment of high value assets beyond 1km where judgement suggests a significant effect is possible.
Biodiversity	**Construction and Operation:** 2km from the scheme boundary. Within this, the ZoI for assessment purposes varies according to specific biodiversity receptors and is informed by best practice guidance from Natural England and the Chartered Institute of Ecology and Environmental Management and other sources. SACs were initially assessed up to 30km where bats are noted as a qualifying feature.
Road drainage and the water environment	**Construction and Operation**: Surface water and groundwater features within a 1km radius of the site boundary. This is based on the 'source-pathway-receptor' pollutant linkage principle. Extension of the study area beyond the 1km buffer may be necessary to capture potential impacts to receptors beyond the standard study area.
Geology and soils	**Construction and Operation**: The ZoI for land contamination will be 2km from the scheme boundary. Groundwater including potable water abstraction, excluding surface water, will be considered within a 1km radius.
Population and health	**Construction and Operation**: The ZoI shall be based on the construction footprint/project boundary (including compounds and temporary land take) plus a 500m buffer area. Where likely effects are identified outside the 500m area surrounding the project boundary, the study area will be extended accordingly.

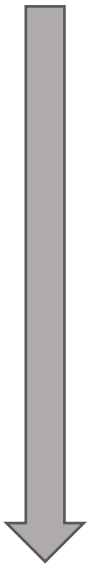
Environmental Topic	Initial Zone of Influence
Material resources	**Construction**: The ZoI comprises the Scheme footprint and the regions within which waste management facilities are located and from where construction materials may be sourced. **Operation**: Materials used, and waste generated will be assessed during the first year of operation.
Climate	GHG emissions: **Construction**: ZoI associated with primary extraction and manufacturing of materials and transportation outside of the indicative DCO boundary as well as site-based emissions that result from construction activities and land-use change within the indicative DCO boundary, including temporary land take and compounds. **Operation**: ZoI for maintenance emissions, defined by the indicative DCO boundary and, for the replacement of materials, the study area includes the extraction and manufacturing of materials and transportation outside of the indicative DCO boundary as well as site-based emissions that result from construction activities within the indicative DCO boundary. The study area for road user emissions is consistent with the Affected Road network as defined by the project's traffic model. Vulnerability to climate change (climate change resilience assessment): **Construction and operation**: ZoI is based on temporary and completed works within the indicative DCO boundary and includes all potential climate hazards for infrastructure, assets and road users associated with the project.

16.2.11 Following the establishment of the initial ZOI for each topic, an initial desk study is undertaken to identify other developments within 500m of the project that may need to be considered for inclusion in the CEA.

Consultation with the LPA (Eden District Council, Cumbria County Council, North Yorkshire County Council, Richmondshire District Council and Durham County Council) will then be undertaken to identify any other developments to be included in the CEA process, including as part of the EIA scoping process . An analysis of the information gathered on the longlist developments will be undertaken to determine the level of certainty, using the tiering system from *AN17* (see

16.2.12 Table 16-2). The final desk study will obtain all publicly available information about the other developments', and this information will be presented in line with *AN17* Matrix 1.

Table 16-2: Cumulative assessment – level of certainty

		Decreasing level of detail likely to be available
Tier 1	Permitted application(s), whether under the Planning Act 2008 or other regimes, but not yet implemented.	
Tier 2	Submitted application(s) whether under the Planning Act 2008 or other regimes but not yet determined.	
Tier 3	Schemes on the Planning Inspectorate's Programme of Projects where a scoping report has been submitted.	
	Identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals would be limited.	
	Identified in other plans and programmes (as appropriate) which set the framework for future development consents / approvals, where such development is reasonably likely to come forward.	

16.2.13 In line with *AN17*, where other developments are expected to be completed before construction of the project and the effects of those are fully determined, effects arising from them will be considered as part of the baseline and may be considered as part of both the construction and operational assessment. The ES will clearly distinguish between projects forming part of the dynamic (future) baseline and those included within the assessment of cumulative effects.

16.2.14 At Stage 2, the process applies threshold criteria to the longlist, in order to establish a shortlist of other developments, and to ensure that the CEA is proportionate. The criteria is used to guide a decision as whether to include or exclude other developments that falls within the ZOI. This will include, but not be limited to, an analysis of the level of detail available on the other developments including their nature, scale and programme. Any other criteria used will be clearly explained in the ES.

16.2.15 Consultation with the LPA and other relevant organisations will be undertaken to ensure that the shortlist is as comprehensive and accurate as possible, and includes all development proposals that LPA would expect to be considered.

16.2.16 Stage 3 will involve undertaking a more detailed desk-based study on the shortlisted other developments to gather further detailed information, to inform the Stage 4 assessment.

16.2.17 *AN17* identifies that the information captured should include but not be limited to:

- Proposed design and location information
- Proposed programme of construction, operation and decommissioning
- Environmental assessments that set out baseline data and effects arising from the 'other existing development and/or approved development'

16.2.18 The information gathered will be presented in line with *AN17* 'Matrix 2'.

16.2.19 At Stage 4 an assessment will be conducted of the potential for cumulative effects with the shortlisted developments on a topic by topic basis. The results of the CEA from each topic will be brought together and presented in the CEA chapter of the ES to allow clear identification of the shortlisted sites and their potential for cumulative residual effects with the project. The assessment will be clearly documented in the ES using the format presented in 'Matrix 2' of *AN17*. The assessment will be proportionate to the effect being assessed.

16.2.20 There will be a need to stop assessment work at a particular point in time in order to be able to finalise the ES (i.e. beyond which no further new applications can be considered within the cumulative assessment). The ES will state the assessment cut-off date. This will also be agreed in consultation with the LPA.

16.2.21 The air quality and noise assessments will draw upon traffic data derived from an inherently conservative regional model in that it already includes allowance for all allocated future development identified within the Local Plans. These developments are captured in the uncertainty log and they inform the traffic model. Therefore, the air quality and noise assessments presented will be inherently cumulative and no additional assessment of these aspects is required.

16.2.22 For the other topics, the assessment will consider the potential effects of the preferred route with other proposed developments.

16.3 Assessment of combined effects

16.3.1 This section presents the receptors identified in the topic chapters of this ESR as having potential to experience cumulative effects as a result of the project. Only receptors with the potential to experience effects from more than one topic have been included.

16.3.2 At this early stage, it is considered that there is the potential for residual cumulative effects on:

- Local residential properties and recreational resources (including PRoW) could experience multiple adverse/beneficial impacts associated with changes to views, light pollution, air pollution and noise and vibration during construction and operation.
- The health of the population could be affected by multiple adverse/beneficial impacts on health determinants including noise, air pollution, views, light pollution, access and severance.
- The project could have adverse effects on local commercial receptors due to changes to views, light pollution, air pollution and noise and vibration.
- Changes to the setting of cultural heritage receptors through changes to views, light pollution, air pollution and noise and vibration during construction and operation.

- Biodiversity receptors could be affected by direct habitat loss, fragmentation, disturbance and air quality impacts.

16.3.3 The nature of some of the assessments means that they are inherently cumualtive. This chapter will only report effects that are not already accounted for in topic chapters.

16.3.4 Construction activities could also result in adverse effects on aquatic biodiversity and water quality which, in combination, could potentially affect the Water Framework Directive (WFD) status of the following waterbodies:

- River Eamont
- River Lowther
- River Eden and its tributaries
- Trout Beck
- Crooks Beck
- River Greta
- River Tees
- Holme Beck
- Scorton Beck

16.3.5 Other receptors that could experience combined effects include landscape and visual receptors that could experience visual, acoustic and land take effects.

16.3.6 Once the project is operational, there is the potential for some residential and commercial properties to experience a combined beneficial impact through improved traffic flows and reduced congestion which may improve local air quality. It would also include increased levels of accessibility through improvements to pedestrian, cyclist and equestrian facilities.

16.3.7 There is likely to be an interaction between different impacts upon the health and well-being of local residents, vehicle users and users of PRoW. Improvements to air quality, journey length and amenity may be offset by nuisance caused by noise, visual amenity and land take.

16.3.8 The combined impacts from air quality and noise and vibration could have a significant beneficial effect on the health of residents along the existing A66 for offline sections of the route. However, they could also combine to have a significant adverse effect on the health of residents where the route is upgraded online if the scheme leads to higher traffic volumes/speeds or for receptors located adjacent to new offline sections.

16.3.9 Where human health effects from more than one topic occur, a qualitative description of the overall population / community and human health effects will be provided within Chapter 16: Assessment of Cumulative Effects in line with current Highways England guidance.

16.3.10 These potential significant residual combined effects will be reviewed and updated throughout the EIA.

Table 16-3: Potential combined effects of the project during construction

Receptor/Resource	Notes	Air Quality	Noise and Vibration	Landscape and Visual	Cultural Heritage	Biodiversity	Road drainage/ water	Geology and soils	Population and health	Materials resources	Climate
Residential receptors	Potential exposure to sources of contamination, changes to views, air quality and noise and vibration, permanent land take and acquisition of private assets. Potential to increase flood risk.	x	x	x			x	x	x		
Users of Public Rights of Way (PRoW)	Potential exposure to sources of contamination, changes to views, air quality and noise and vibration, severance and increases to journey length, reduced amenity. Potential to increase flood risk.	x	x	x			x	x	x		
Users of Community Land and Facilities	Potential exposure to sources of contamination, changes to views and noise and vibration, reduced amenity. Potential to increase flood risk.		x	x			x	x	x		
Ecological sites within close proximity to the project	Potential increase in nitrogen deposition on sensitive designated ecological sites above the critical load as a result of increased traffic capacity.	x				x					
Cultural Heritage receptors	Changes to the setting of a cultural heritage features through changes in views, noise and vibration, air pollution and light pollution.	x	x	x	x						

Table 16-4: Potential combined effects of the project during operation

Receptor/Resource	Notes	Air Quality	Noise and Vibration	Landscape and Visual	Cultural Heritage	Biodiversity	Road drainage/ water	Geology and soils	Population and health	Materials resources	Climate
Residential receptors	Changes to views and noise and vibration, Potential to increase flood risk. Access to health care services and social infrastructure. Changes in NO_2 concentrations.	x	x	x			x		x		
Users of PRoWs	Changes to views and noise and vibration, Impacts on health determinants. Potential to increase flood risk. Changes in NO_2 concentrations.	x	x	x			x				
Users of Community Land and Facilities	Changes to views and noise and vibration, Potential to increase flood risk. Changes in NO_2 concentrations.	x	x	x			x				

16.4 Assessment of cumulative effects

16.4.1 There is potential for significant cumulative project effects across all disciplines, this may be as a result of increased traffic with all schemes affecting air quality and noise levels at receptors. Equally there could, for example, be additional land take and nitrogen deposition affecting designated sites.

16.4.2 An initial desk study has been undertaken to search for other developments. Consultation with the LPA (Eden District Council, Cumbria County Council, North Yorkshire County Council, Richmondshire District Council and Durham County Council) will be undertaken to identify any other developments to be included in the CEA.

16.4.3 The air quality and noise assessments will analyse data provided by the traffic model, which incorporates potential future development. Therefore, the impacts presented in the ES will be inherently cumulative. This is also applicable to the assessment of nitrogen deposition on designated ecological sites in Chapter 6: Air Quality.

16.4.4 Four residential developments were identified as being in planning and construction phases within 2km of the project at the earlier Option Selection stage. These developments will be considered in line with the CEA methodology proposed in this chapter. These developments could potentially introduce additional receptors who would benefit from the improvements to journey length, community severance and amenity.

16.4.5 The CEA will be reviewed and updated throughout the EIA. A full assessment of the cumulative impacts from different projects together with the project will be presented in the ES.

16.5 Assumptions and limitations

16.5.1 *AN17* acknowledges that “the availability of information necessary to conduct the CEA will depend on the current status of the ‘other existing development and/or approved development”.

16.5.2 The CEA will clearly state any assumptions or limitations in relation to the other existing development and/or approved development data collected. The CEA will assign a level of certainty, reflecting the availability of detail and information necessary for the assessment, to each development proposal. A pragmatic approach and professional judgement will be taken when determining what is feasible and reasonable, and will be agreed where possible with the relevant LPA.

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17.2 Glossary

Term	Definition
Abutment	A point where two structures meet, which support or anchor the end of a bridge.
Accommodation bridge	A bridge under or over the A66 that serves an affected area of land or property, not considered a public highway.
Accommodation/access road or track	A new or altered access road or track serving an affected area of land or property, not considered a public highway.
Affected Road Network (ARN)	Those roads within the traffic reliability area which, in the opening year of the project, meet specific criteria set out in DMRB.
Agricultural Land Classification (ALC)	A relative measure of agricultural land quality in England and Wales. In practice, the ALC grades are defined by reference to the land's physical characteristics. The most productive and flexible land falls into Grades 1 & 2 and Subgrade, 3a and collectively comprises about one-third of the agricultural land in England and Wales. About half the land is of moderate quality in Subgrade 3b or poor quality in Grade 4. The remainder is very poor-quality land in Grade 5, which mostly occurs in the uplands.
Air Quality Action Plan (AQAP)	A plan that must be compiled by a local authority if it declares an air quality management area.

Term	Definition
Air quality exceedance	An instance of pollutant concentrations exceeding an air quality standard.
Air quality limit value	A maximum concentration to be achieved in the atmosphere, either without exception or with a permitted number of exceedances. Limit values are defined in European Union Directives and implemented in UK legislation.
Air Quality Management Area (AQMA)	An area within a local authority boundary where the air quality objectives are not likely to be achieved. The local authority is required to declare the area as an air quality management area and to prepare a local air quality action plan.
Air quality objectives	Policy targets generally expressed as a maximum ambient pollutant concentration to be achieved. The objectives are set out in the UK Government's Air Quality Strategy for the key air pollutants.
Air quality standard	Air quality limit values and objectives.
ALARP principle	As low as reasonably practicable – the principle of weighing a risk against the time and cost needed to control it.
Alluvial deposits	Natural materials deposited within and adjacent to rivers.
Alluvium	Loose, unconsolidated material comprising clay, silt, sand, gravel deposited by flowing water, typically in floodplain areas, which can contain layers of peat.
Ambient sound	The all-encompassing sound at a given location and time. It will generally include sound from many sources near and far. Ambient sound can be quantified in terms of the equivalent continuous sound pressure level, $L_{pAeq,T}$.
Ancient woodland	Land that has been continually wooded since at least 1600 AD.
Ancient Woodland Inventory (AWI)	A map-based record of all ancient woodland in England and Wales over 2ha in area.
Appropriate Assessment	An assessment required by the Habitats Directive and Regulations where a project (or plan) would be likely to have a significant effect on a European site, either alone or in combination with other plans or projects (part of the Habitats Regulations Assessment process).
Aquifer	An underground rock formation containing water, often used as a water source.
Area of Outstanding Natural Beauty (AONB)	An area designated under Section 82(1) of the Countryside and Rights of Way Act 2000 for the purpose of conserving and enhancing its natural beauty.
Attenuation	Reduction. The term used in drainage design to indicate a reduction in the rate of flow or flooding risk, for example, by means of a pond to hold back water.

Term	Definition
Balancing pond	Part of a drainage system that is used to temporarily store, and thereby attenuate, the flow of surface water run-off.
Baseline	Existing environmental conditions present on, or near a site, against which future changes can be measured or predicted.
Bedrock	A term used for the main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water. Formerly known as 'solid' geology by BGS.
Best and most versatile (BMV) land	Land defined as grade 1, 2 or 3a of the Agricultural Land Classification. This land is considered the most flexible, productive and efficient and is most capable of delivering crops for food and non-food uses.
Best Available Techniques (BAT)	The available techniques which are the best for preventing or minimising emissions and impacts on the environment. Techniques include both the technology used and the way an installation is designed, built, maintained, operated and decommissioned.
Best Practicable Means (BPM)	Defined in the Control of Pollution Act 1974 and Environmental Protection Act 1990. Used to describe measures that are 'reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to financial implications'.
Biodiversity	Biological diversity: The variety of life forms in a given area, includes all species of plants and animals, their genetic variation and the complex ecosystems of which they are part.
Biodiversity Action Plan (BAP)	A nationally established programme that seeks to protect and restore threatened species, habitats and biological systems.
Borehole	A hole bored into the ground, usually as part of investigations, typically to test the depth and quality of soil, rock and groundwater. A borehole can also be used to dewater the ground.
Bridge deck	The road or pedestrian walkway that forms the surface of a bridge.
Bridge soffit	The underside of a bridge.
Conservation Area	Defined at Section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990 as those parts of a local planning authority area of special architectural or historic interest the character or appearance of which it is desirable to preserve or enhance.
Controlled waters	Defined in section 104 of the Water Resources Act 1991. They include in summary:

Term	Definition
	a) relevant territorial waters which extend seaward for three miles from the low-tide limit from which the territorial sea adjacent to England and Wales is measured; b) coastal waters from the low-tide limit to the high-tide limit or fresh-water limit of a river or watercourse; c) inland freshwaters: • natural and artificial lakes, ponds, reservoirs, rivers or watercourses above the fresh-water limit; • natural and artificial underground rivers and watercourses; • surface water sewers, ditches and soakaways that discharge to surface or groundwater; • it also includes those that may be currently dry; and d) groundwaters– any waters contained in underground strata.
Cumulative effects	The combined residual effects of a project in its entirety (all schemes), and the combined effects with other projects.
Cutting	A section of road where the surrounding land is at a higher level and the ground has been dug away to put in the road.
Decibel (dB)	Measurement of noise on a logarithmic scale. The range of audible sound pressures is approximately 0 dB to 140 dB. A single dB figure is unhelpful as it describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.
Designer	The organisation commissioned to undertake the various stages of scheme preparation and supervision of construction. This includes specialise subconsultants brought in to advise on specific areas of assessment and mitigation.
Design speed	The design speed is a tool used to determine geometric features of a new road design based on the anticipated vehicle speeds on the road.
Design Year	In the case of this scheme, 15 years after assumed opening.
Development Consent Order (DCO)	A Development Consent Order is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects. This includes energy, transport, water and waste projects.
Do-Minimum	Future situation assuming no scheme is provided, but that maintenance is on-going.
Do-Nothing	The existing network without modification in the Opening Year/Design Year.
Do-Something	The road project under consideration in the Opening Year /Design Year
Earthworks	The process of excavating or increasing level of soil.

Term	Definition
Effect	Term used to express the consequence of an impact (expressed as the 'significance of effect').
Embedded mitigation	Design measures which are integrated into a project for the purpose of minimising environmental effects.
Enhancement	A measure that is over and above what is required to mitigate the adverse effects of a project.
Environmental Management Plan (EMP)	Provides the framework for recording environmental risks, commitments and other environmental constraints and clearly identifies the structures and processes that will be used to manage and control these aspects. The EMP also seeks to ensure compliance with relevant environmental legislation, government policy objectives and scheme specific environmental objectives. It also provides the mechanism for monitoring, reviewing and auditing environmental performance and compliance.
Floodplain	A floodplain or flood plain is an area of land adjacent to a stream or river which stretches from the banks of its channel to the base of the enclosing valley walls and which experiences flooding during periods of high discharge.
Future baseline	An outline of the likely evolution of the current state of the environment without implementation of the project.
Flood Warning and Evacuation Plan	Documented strategy for making occupants aware of potential flood risks, procedures for receiving and disseminating flooding information (such as flood warnings form the Environment Agency) and the actions to be taken.
Flood Zone 1	Land having a less than 1 in 1,000 annual probability of river or sea flooding.
Flood Zone 2	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Flood Zone 3	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Greenhouse Gas	A gas that helps contribute towards global warming by trapping heat given off from the earth's surface. Under the UN's Kyoto Protocol, the 6 GHG gases are carbon dioxide, methane, nitrous oxide, perfluorocarbons, hyrdofluorocarbons and sulphur hexafluoride.
Groundwater	Groundwater is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations.
Heavy Duty Vehicle (HDV)	As HGV with the inclusion of buses and coaches.
Heavy Goods Vehicle (HGV)	A goods vehicle over 3.5 tonnes, including rigid and articulated lorries.

Term	Definition
Heritage Resources	Heritage Resources are those resources, both human and natural, created by activities from the past that remain to inform present and future societies of that past
Historic Environment	All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora.
Historic Environment Record (HER)	Information services that provide access to comprehensive and dynamic resources relating to the archaeology and historic built environment of a defined geographic area.
Listed Building	Building or structure listed by the SoS as being of 'special architectural or historic interest'.
Light Detection and Ranging (LIDAR)	A remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.
Local Authority	An administrative body of local government.
Lowest Observed Adverse Effect Level (LOAEL)	This the level of noise exposure above which adverse effects on health and quality of life can be detected.
Materials Management Plan (MMP)	A Materials Management Plan (MMP) is a mechanism by which those who are developing a site can comply with Environment Agency regulations for excavated ground materials.
National Cycle Network (NCN)	The National Cycle Network is a series of safe, traffic-free paths and quiet on-road cycling and walking routes that connect to every major town and city.
National Planning Policy Framework (NPPF)	The National Planning Policy Framework sets out the Government's planning policies for England.
National Pond Survey	National scheme to develop a classification of ponds in Britain based on the composition of their plant and macroinvertebrate communities.
Nationally Significant Infrastructure Project (NSIP)	Any infrastructure project that is deemed, according to the criteria set in the Planning Act, 2008 (as amended) to be nationally significant. Such projects are authorised through a statutory process that requires an application for a DCO, rather than a conventional planning application or the traditional model through the publication of Statutory Orders and the holding of Public Inquiries.
Noise Important Areas	These areas provide a framework for the local management of the Important Areas.
Opening Year	In the case of this scheme, assumed to be 2029.
Paris Agreement (climate)	The Paris Agreement, Paris climate accord or Paris climate agreement, is an agreement within the United Nations

Term	Definition
	Framework Convention on Climate Change dealing with greenhouse gas emissions mitigation, adaptation and finance starting in the year 2020.
Parish Council	A civil local authority in England, the lowest tier of local government. They are elected corporate bodies, have variable tax raising powers, and are responsible for areas known as civil parishes, serving in total 16 million people.
Planning Inspectorate (PINS)	On 1 April 2012, under the Localism Act 2011, the Planning Inspectorate became the agency responsible for operating the planning process for nationally significant infrastructure projects (NSIP).
Pollution Prevention Guidelines (PPG)	Practical advice and guidance for the prevention of pollution during construction and demolition projects. The guidance explains what is required by law and describes good practice measures to reduce the risks of a pollution incident.
Principal Aquifer	These are layers of rock or drift deposits that have high intergranular and / or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale.
Public Rights of Way (PRoW)	A way over which the public have a right to pass and repass. The route may be used on foot, on (or leading) a horse, on a pedal cycle or with a motor vehicle, depending on its status. Although the land may be owned by a private individual, the public may still gain access across that land along a specific route
Receptor	Environmental feature that has the potential to be adversely or beneficially affected by an impact of the project, e.g. local residents, wildlife and water bodies.
Residual impact	Effects on the environment that occur after mitigation of potential impacts has been implemented.
Road Investment Strategy (RIS)	The Road Investment Strategy outlines a long-term programme for England's motorways and major roads supported by stable funding needed to plan ahead.
Scheduled Monument	Historic building or site included in the Schedule of Monuments kept by the Secretary of State for Culture, Media and Sport under the regime set out in the Ancient Monuments and Archaeological Areas Act 1979.
Scheme Assessment Report (SAR)	The main aims of the assessment reporting process are to permit consideration of the likely environmental, economic and traffic effects of alternative proposals, and to allow the public and statutory bodies to comment on proposals taking account of their environmental, economic and traffic implications

Term	Definition
Scoping	The process of considering the information required for reaching a (reasoned) conclusion on the likely significant effects of a project on the environment.
Scoping Opinion	A written opinion of the relevant consenting authority, following a request from the applicant, as to the information to be provided in the Environmental Statement.
Secondary A Aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Secondary B Aquifer	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
Secondary (undifferentiated) Aquifer	Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type.
Significant Observed Adverse Effect Level (SOAEL)	This is the level of noise exposure above which significant adverse effects on health and quality of life occur.
Site of Special Scientific Interest (SSSI)	A conservation designation denoting a protected area in the United Kingdom, designated due to special interest in its flora, fauna, geological or physiographical features. They are protected by law to conserve their wildlife or geology.
Site Waste Management Plan (SWMP)	A management plan to encourage the effective management of materials and ensure waste is considered at all stages of a project - from design through to completion. Although no longer a regulatory requirement in England, SWMPs are still considered to be good practice.
Source Protection Zone (SPZ)	Area of groundwater protected by the Environment Agency.
Special Area of Conservation (SAC)	Site designated under the Habitats Directive. These sites, together with Special Protection Areas (or SPAs), are called Natura sites and they are internationally important for threatened habitats and species.
Special Protection Area (SPA)	A special protection area is a designation under the European Union Directive on the Conservation of Wild Birds. Under the Directive, Member States of the European Union (EU) have a duty to safeguard the habitats of migratory birds and certain particularly threatened birds.
Stakeholder	An organisation or individual with a particular interest in the project.
Statement of Common Ground (SoCG)	A written statement prepared jointly by the applicant and another party or parties, setting out any matters on which they agree. In some cases, statements of common ground

Term	Definition
	will also identify areas where agreement has not been reached.
Statutory consultees	Individuals or groups which are contacted and requested to provide information or comment on a scheme, legally recognised under statute.
Statutory Environmental Bodies (SEB)	Environment Agency, Historic England and Natural England.
Study Area	The spatial area within which environmental effects are assessed i.e. extending a distance from the DCO boundary in which significant environmental effects could occur (this may vary between the topic areas).
Superficial Deposits	The youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 2.6 million years from the present. They rest on older deposits or rocks referred to as bedrock.
Sustainable drainage systems (SuDS)	Drainage solutions that provide an alternative to the direct channeling of surface water through networks of pipes and sewers to nearby watercourses.
Unexploded ordnance (UXO)	Unexploded ordnance, unexploded bombs, or explosive remnants of war are explosive weapons that did not explode when they were employed and still pose a risk of detonation, sometimes many decades after they were used or discarded.
Waste hierarchy	The waste hierarchy ranks waste management options according to what is best for the environment. It gives top priority to preventing waste in the first place. When waste is created, it gives priority to preparing it for re-use, then recycling, then recovery, and last of all disposal (e.g. landfill).
Waste Local Plan	Provides further information in support of the implementation of waste planning policy.
Water Framework Directive (WFD)	The Water Framework Directive (2000/60/EC) (WFD) is a wide- ranging piece of European environmental legislation for the protection of water resources that is being transposed into UK Law.
World Health Organisation (WHO)	The World Health Organization is a specialized agency of the United Nations that is concerned with international public health.
World Heritage Site	A World Heritage Site is a landmark or area with legal protection by an international convention administered by the United Nations Educational, Scientific and Cultural Organization (UNESCO). World Heritage Sites are designated by UNESCO for having cultural, historical, scientific or other form of significance.

Term	Definition
Zone of Visual Influence (ZVI)	The area within which a project may be visible and may influence the quality of views. The 'zone of visual influence' approximately covers all land from which the project is visible. It is limited by topographic features such as hill and valleys and by visual barriers such as woodland and buildings.
Zone ot Theoretical Visibility	The zone from which the project is theoretically visible over 'bare earth.'

17.3 Abbreviations

Abbreviation	In Full
AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekly Traffic
ADMS	Advanced Dispersion Modelling System
AHLV	Areas of High Landscape Value
ALARP	As Low As Reasonable Practicable
ALC	Agricultural Land Classification
AMAA	Ancient Monuments and Archaeological Area
AN17	Advice Note 17
ANC	Association of Noise Consultants
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
APIS	Air Pollution Information System
APHA	Animal and Plant Health Agency
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
ARN	Affected Road Network
ASR	Annual Status Report
ASSI	Area of Special Scientific Interest
AWI	Ancient Woodland Inventory
BACI	Before-After-Impact-Control
BAP	Biodiversity Action Plan
BAT	Best Available Techniques
BCT	Bat Conservation Trust
BEIS	Department for Business, Energy and Industrial Strategy
BG	British Gypsum
BGS	British Geological Survey
BMV	Best and Most Versatile
BMX	Bicycle Moto Cross
BNG	Biodiversity Net Gain
BNL	Basic Noise Level
BoCC	Birds of Conservation Concern
BPM	Best Practicable Means
BS	British Standard
BTO	British Trust for Ornithology
CA	Coal Authority

Abbreviation	In Full
CAA	Civil Aviation Authority
CBDC	Cumbria Biodiversity Data Centre
CCR	Climate Change Risk
CD&E	Construction, Demolition and Excavation
CDW	Construction and Demolition Waste
CE	Circular Economy
CEA	Cumulative Effects Assessment
CERC	Cambridge Environmental Research Consultants Ltd
ch	Chainage
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CL:AIRE	Contaminated Land: Applications in Real Environments
cm	Centimetre
CO_2	Carbon Dioxide
CoCP	Code of Construction Practice
COPD	Chronic Obstructive Pulmonary Disease
CRTN	Calculation of Road Traffic Noise
CWS	County Wildlife Site
DBA	Desk-Based Assessment
DCMS	Department for Culture, Media and Sport
DCO	Development Consent Order
Defra	Department for Environment Food and Rural Affairs
DfT	Department for Transport
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges
DoW CoP	Definition of Waste Code of Practice
DS	Do-Something
EAR	Environmental Assessment Report
ECI	Early Contractor Involvement
EcIA	Ecological Impact Assessment
ECoW	Ecological Clerk of Works
EDF	Environmental Designated Funds
EDI	Equality, diversity and inclusion
EDIT	Equality, Diversity and Inclusion sifting Tool
EDM	Energy Demand Model
EFT	Emission Factor Toolkit
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
END	Environmental Noise Directive
ERICNE	Environmental Records Information Centre North East
ES	Environmental Statement
ESR	Environmental Scoping Report
EU	European Union
FEP	Farm Environment Plan
FRA	Flood Risk Assessment
FRAP	Flood Risk Activity Permit
FSC	Forest Stewardship Council
FY	Future Year
GCR	Geological Conservation Review

Abbreviation	In Full
GHG	Greenhouse Gas
GI	Ground Investigation
GIS	Geographical Information Systems
GLVIA3	Guideline for Landscape and Visual Impacts Assessment 3rd Edition
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependant Terrestrial Ecosystems
Ha	Hectare
HAGDMS	Highways Agency Geotechnical Data Management System
HDV	Heavy Duty Vehicle
HEMP	Handover Environmental Management Plan
HER	Historic Environment Record
HEWRAT	Highways England Water Risk Assessment Tool
HGV	Heavy Goods Vehicle
HLC	Historic Landscape Characterisation
HLS	Higher Level Stewardship
HRA	Habitats Regulations Assessment
HSI	Habitat Suitability Index
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
IEMA	Institute of Environmental Management and Assessment
IMD	Index of Multiple Deprivation
IOA	Institute of Acoustics
IPT	Integrated Project Team
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
km	Kilometre (Unit of Measurement)
km/hr	Kilometre per hour
LAA	Local Aggregates Assessments
LCA	Landscape Character Assessment
LCRM	Land Contamination: Risk Management
LEMP	Landscape and Ecological Management Plan
LGS	Local Geology or Geodiversity Site
LI	Landscape Institute
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LOAEL	Lowest Observed Adverse Effect Level
LPA	Local Planning Authority
LSPA	Layer Super Output Areas
LWS	Local Wildlife Site
m	Metres (Unit of Measurement)
MAFF	Ministry of Agriculture Fisheries and Food
MAGIC	Multi-Agency Geographic Information for The Countryside
mbgl	Metres below ground level
MD	Multiple Deprivation
MHCLG	Ministry of Housing, Communities and Local Government
MIEU	Major Infrastructure Environment Unit
mm	Millimetres
MMP	Materials Management Plan

Abbreviation	In Full
MoD	Ministry of Defence
MRS	Metal Recycling Site
MSA	Mineral Safeguarding Areas
mt	million tonnes
$MtCO_2e$	Million tonnes of carbon dioxide equivalents
mtpa	million tonnes per annum
NBN	National Biodiversity Network
NCA	National Character Areas
NCN	National Cycle Network
NEYEDC	North & East Yorkshire Ecological Data Centre
NFU	National Farmers Union
NGR	National Grid Reference
NHLE	National Heritage List England
NIA	Noise Important Area
NII	National Infrastructure Inspectorate
NIR	Noise Insulation Regulations
NMU	Non-Motorised Users
NNR	National Nature Reserve
NO_2	Nitrogen Dioxide
NOEL	No Observed Effect Level
NOx	Oxides of Nitrogen
NPPF	National Planning Policy Framework
NPSE	Noise Policy Statement for England
NPSNN	National Policy Statement for National Networks
NSIP	Nationally Significant Infrastructure Project
NSRI	National Soil Resources Institute
NTP	Northern Trans-Pennine
NTPR	Northern Trans-Pennine Routes
NTS	Non-Technical Summary
NVC	National Vegetation Classification
NVMP	Noise and Vibration Management Plan
^oC	Degrees Celsius
ONS	Office for National Statistics
OWC	Ordinary Watercourse Consent
OS	Ordnance Survey
OY	Opening Year
PAQAP	Project Air Quality Action Plan
PAS	Publicly Available Specification
PCC	Preferred Construction Contractor
PCF	Project Control Framework
PCM	Pollution Climate Mapping
PEA	Preliminary Ecological Appraisal
PEI	Preliminary Environmental Information
PHI	Priority Habitat Inventory
PINS	Planning Inspectorate
PM	Particulate Matter
PM2.5	Particulate Matter 2.5 micrometres or less in diameter
PM_{10}	Particulate Matter 10 micrometres or less in diameter
POPE	Post Opening Project Evaluation
PPE	Personal Protective Equipment

Abbreviation	In Full
PPG	Pollution Prevention Guidelines
PRoW	Public Rights of Way
PWM	Precautionary Working Methods
RCS	River Corridor Survey
RCP	Representative Concentration Pathways
REAC	Register of Environmental Actions and Commitments
RHS	River Habitat Survey
RIS	Road Investment Strategy
RIS1	First Road Investment Strategy
RIS2	Second Road Investment Strategy
RLR	Rural Land Registry
RSPB	Royal Society for the Protection of Birds
RPG	Registered Park and Gardens
RTA	Road Traffic Accident
SAC	Special Area of Conservation
SAR	Scheme Assessment Report
SEB	Statutory Environmental Bodies
SEDEX	Supplier Ethical Data Exchange and the Sustainable Sourcing Code
SINC	Site of Importance for Nature Conservation
SNRHW	Stable Non-Reactive Hazardous Waste
SOAEL	Significant Observed Adverse Effect Level
SoCG	Statements of Common Ground
SoS	Secretary of State
SPA	Special Protection Area
SPZ	Source Protection Zone
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Strategy
SWMP	Site Waste Management Plan
TAG	Transport Analysis Guidance
TAR	Technical Appraisal Report
TIN	Technical Information Note
TMP	Traffic Management Plan
TPO	Tree Preservation Order
TRA	Traffic Reliability Area
TRADA	The Timber Research and Development Association
TWG	Technical Working Groups
µg/m^3	Micrograms per cubic meter
UK	United Kingdom
UKCP18	United Kingdom Climate Projections 18
UNESCO	United National Educational, Scientific and Cultural Organization
UXO	Unexploded Ordnance
WCHAR	Walking, Cycling Horse Riding Assessment and Review
WCH	Walkers, Cyclists and Horse-Riders
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WHO	World Health Organization
WRAP	Waste and Resources Action Programme

Abbreviation	In Full
WWII	World War Two
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility
ZVI	Zone of Visual Influence

18 Figures

A Major Events

A.1 Introduction

This section presents the findings of the route-wide assessment of likely significant environmental effects arising directly from the project if it were to be affected by a major accident and/or disaster (hereafter referred to as major events in line with Design Manual for Roads and Bridges (DMRB) terminology).

The Environmental Impact Assessment (EIA) Regulations require consideration of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to major events. This section sets out the methodology behind the assessment and presents a baseline of existing sources of risk assessment to provide an assessment of the probability, likelihood and frequency of a major event deriving from the vulnerability of the project. Major events include both man-made and naturally occurring events.

A.2 Legislation

Schedule 4 of the *Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended)* (Legislation, 2017)[246] requires an Environmental Statement (ES) to consider:

"A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned;

Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies."

"Risks to human health, cultural heritage or the environment from the project (for example, including accidents and disasters)."

The design, management, operation and maintenance of the project must comply with the following United Kingdom (UK) legislation and European Union (EU) regulations:

- *EU Regulation 402/2013* (Official Journal of the European Union, 2013)[247] on the Common Safety Method on Risk Evaluation and Assessment (CSM-RA) (as amended by EU Regulation 2015/1136). An EU Regulation that describes the methods required to be used to assess compliance with safety levels and safety requirements.
- *Health and Safety at Work etc. Act 1974 (as amended)* (Legislation, 1974)[248] (HSWA). This legislation places general duties on employers, people in control

[246] Legislation (2017) Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended), available from https://www.legislation.gov.uk/uksi/2017/572/pdfs/uksi_20170572_en.pdf
[247] Official Journal of the European Union (2013) Commission Implementing Regulation (EU) No. 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009, available at: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32013R0402
[248] Legislation (1974) Health and Safety at Work Act 1974 (as amended), available at: https://www.legislation.gov.uk/ukpga/1974/37/pdfs/ukpga_19740037_en.pdf

of premises, manufacturers and employees. Health and safety regulations made under this Act contain more detailed provisions. The Act provides the framework for the regulation of industrial health and safety in the UK. The overriding principle is that foreseeable risks to persons shall be reduced so far as is reasonably practicable and that adequate evidence shall be produced to demonstrate that this has been done.

- The *Management of Health and Safety at Work Regulations 1999 (as amended)* (Legislation, 1999)[249]. These regulations generally make more explicit what employers are required to do to manage health and safety under the HSWA.
- Construction Design and Management (CDM) 2015 Regulations (as amended) (Legislation, 2015)[250]. These regulations place specific duties on clients, designers and contractors, so that health and safety is taken into account throughout the life of a construction project from its inception to its subsequent final demolition and removal. Under CDM regulations, designers have to avoid foreseeable risks so far as reasonably practicable by: eliminating hazards from the construction, cleaning, maintenance, and proposed use and demolition of a structure; reducing risks from any remaining hazard; and giving collective safety measures priority over individual measures.

In broad terms, risks associated with major accidents and disasters (hereafter referred to as major events) will be identified, assessed and mitigated during the design, construction, operation and maintenance of the project. The legislation described above sets out the requirement, duties, and in some cases establishes the mechanisms for doing this.

In accordance with Regulation 5 of the revised *Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended)*, safety assessments undertaken for the project have been used to inform the identification and assessment of major accidents and natural disasters to which the project may be vulnerable.

The project is being designed and its implementation guided by other industry standards and codes, many of which are mandatory. These require infrastructure and systems to be designed so that risks to people and the environment are either eliminated or reduced to levels that are considered acceptable.

A.3 Methodology

The methodology adopted for this assessment was developed to align with the methodology in Institute of Environmental Management and Assessment (IEMA) guidance on the topic (Institute of Environmental Management and Assessment, 2020)[251]. This describes the approach used to assess the potential for significant

[249] Legislation (1999) Health and Safety. The Management of Health and Safety at Work Regulations 1999 (as amended), available at: https://www.legislation.gov.uk/uksi/1999/3242/pdfs/uksi_19993242_en.pdf
[250] Legislation (2015) Health and Safety 2015 (as amended). The Construction (Design and Management) Regulations 2015, available at: https://www.legislation.gov.uk/uksi/2015/51/pdfs/uksi_20150051_en.pdf
[251] Institute of Environmental Management and Assessment (2020) Environmental Impact Assessment Guide to: Major Accidents and Disasters, accessed 6 January 2021, https://www.iema.net/resources/blog/2020/09/23/iema-major-accidents-and-disasters-in-eia-primer

effects (during construction and operation) of major accidents and disasters and the assumptions and exclusions.

Major events that are relevant to and can affect a project, both man-made and naturally occurring, were identified. Where major events were identified, the potential for any change in the assessed significance of the project on relevant environmental topics was described in qualitative terms and likely mitigation measures included as part of the assessment.

In line with the IEMA guidance previously quoted, for the purpose of this assessment, a major event is defined as an event that threatens immediate or delayed loss of life or permanent injury and/or serious long lasting or permanent damage to the environment and requires the use of resources beyond those of Highways England or its contractors to manage. This could be internal to the project (e.g. retaining wall collapse) or an external event that could affect the project (e.g. a flood).

A disaster is defined as a naturally occurring phenomenon such as an extreme weather event (e.g. storm, flood, temperature) or ground-related hazard events (e.g. subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a major event.

Vulnerability refers to 'exposure and resilience' of the project to the risk of a major accident and/or natural disaster in the context of the EIA Regulations. An identified, unplanned event, which is considered relevant to the project and has the potential to be a major accident or natural disaster, subject to assessment of its potential to result in significant adverse effects on an environmental receptor, is referred to as a 'risk event'. In considering the elements of vulnerability, professional judgement has been applied to develop project specific definitions of major events and to determine the overall pre and post-mitigation consequence rating of each of the major events.

The assessment evaluates the potential for significant effects (during construction and operation) of major events following a three-stage approach:

- Stage 1: a longlist of all possible major events was developed. This list draws upon a variety of sources, including the UK Government's Risk Register of Civil Emergencies. Major events with little relevance in the UK are excluded. Stage 1 included an initial review of potential receptors to identify any groups it may not be necessary to include in the assessment.
- Stage 2: a screening exercise was undertaken to review the longlist of major events and to give consideration to their relevance to the project, and therefore whether they should be included on the project-specific shortlist of events requiring further consideration by topic specialists.
- Stage 3: if further design mitigation is unable to remove the potential interaction between a major event and a particular topic, the relevant ES chapter would then identify the potential consequence for receptors covered by the topic, and give a qualitative evaluation of the potential for the significance of the reported effect to be increased as a result of a major event. Stage 3 assessment was not considered to be required, based on the conclusions of Stage 2.

The assessment undertaken is presented in the remainder of this appendix.

A.4 Study area

The study area for this assessment is the indicative Development Consent Order (DCO) boundary plus a 500m buffer. There is no specific guidance on the extents of the study area for major events, so this boundary has been selected to align with the maximum study area utilised by other environmental topics. An environmental receptor that could be vulnerable to a major events risk, but is outside the scope of the wider EIA, is very unlikely so the study area has been selected to align with the other topics considered under the EIA.

A.5 Baseline conditions

The baseline conditions for the study area applicable to each topic are discussed in the relevant topic chapter of this ESR.

The assessment of major incidents and disasters shall consider previous recorded major events in the study area as part of the baseline. The main sources of historical major events in the area of the project is due to inclement weather and blind spots due to vegetation and road layout.

As the A66 is located on high ground, greater than 400m above sea level in sections of the road, there is an increased risk of fog, snows and high winds. Fog reduces visibility and is known to cause accidents and long queues. The higher ground also means lower temperatures which leads to ice and frost forming over night and cause problems in the morning. Snow in this area also is known to cause accidents, to the extent that Highways England have fiitted snows gates on the A66, which are closed when bad snow is forecast.

There are several accident blackspots along the routes. This is due to vehicles and other road users being required to cross sections of dual carriage using a central reserve from sides roads and private entrances to access the A66, and due to speed changes as a result of the variable sections of dual carriageway/single carriageway. This is particularly difficult during inclement weather and periods of high traffic flows.

Vegetation and the layout of the road also reduces visability, making it difficult to see cars approaching when attempting to access the A66 from side roads or private means of access.

Flooding also occurs periodically along this route. Sections of the A66 have previously had to close either partially or entirely due to excessive flooding.

A.6 Assessment

Stage 1: longlist

A longlist of possible major events (‘risks’) was developed. This list drew upon a variety of sources, including the *UK National Risk Register of Civil Emergencies*

(Cabinet Office, 2017)[252], the project risk register and the project design hazard assessment log.

In general, major events relating to the project fall into three categories:

- Events that could not realistically occur, due to the type of project or its location.
- Events that could realistically occur, but for which the project, and associated receptors, are no more vulnerable than any other development.
- Events that could occur, and to which the project is particularly vulnerable, or which the project has a particular capacity to exacerbate the effects of.

The aim of the screening process was to identify major events which fall into the third category.

The assessment therefore typically focused on low likelihood but potentially high consequence events. This screening stage included input from a number of topic specialists whose topics are most likely to interact with major events.

For each identified major event, the longlist details the relevance of the major event to the project and the potential receptors. If the major event was considered relevant to the project, it is indicated to be taken forward to the shortlist to be considered further.

The longlist is presented in Table A-18-1.

Table A-18-1: Longlist

Major event		Relevance to the project	Potential receptors	Include in shortlist?
Natural disasters				
1	Geological disasters			
1.1	Slope instability, including landslides and rockfall	There is potential for landslides in the study area. The steep slopes located near the A66 could generate instability during construction due to unforeseen ground conditions (e.g. presence of gulls) or reactivation or relic landslides. Severe weather can trigger slope instability, for example through	Road users Infrastructure Construction works Maintenance workers Environment & Landscape	Yes

[252] Cabinet Office (2017) National Risk Register of Civil Emergencies, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/644968/UK_National_Risk_Register_2017.pdf

Major event		Relevance to the project	Potential receptors	Include in shortlist?
		increased pore water pressure.		
1.2	Earthquakes	The site is not in a seismically active area and as such earthquakes are not considered to be a risk to, or can occur as a result of, the project.	N/A	No
1.3	Sinkholes	Construction over unforeseen ground conditions (e.g. presence of gulls, natural cavities or dissolution features) and consolidation and differential settlement of compressible soils due to applied load embankment materials could generate sinkholes.	Road users Infrastructure Construction works Environment & Landscape	Yes
1.4	Volcanic eruptions	The site is not in a volcanic area and as such volcanic eruptions are not considered to be a risk to the project.	N/A	No
2	Hydrogeological disasters			
2.1	Floods	There is a history of flooding on the A66 and the project has the potential to exacerbate this flooding by altering flow paths (e.g. waterbodies crossings) and increasing peak run-off. This should be considered in terms of the risk to the project and the increased risk to	Waterways Infrastructure Road users Downstream water Environment & Communities	Yes

Major event		Relevance to the project	Potential receptors	Include in shortlist?
		receptors due to the project.		
2.2	Tsunami/storm surge	Not applicable as this site is not in a coastal location.	N/A	No
3	Meteorological disasters			
3.1	Blizzards, storms and gales	Blizzards could cause adverse conditions on the project, causing accidents, traffic delays or trapping roads users. However, the risk is not considered to be any greater as a result of the project.	Road users	No
3.2	Fog, mist and reduced visibility	Severe weather could cause decreased visibility along the A66. However, the risk is not considered to be any greater as a result of the project.	Road users	No
3.3	Cyclonic storms	Not applicable to the UK climate.	N/A	No
3.4	Droughts	Droughts are considered a disaster when a sustained lack of rainfall causes a water shortage. This can cause fatalities amongst vulnerable groups, disruption to essential services, environmental damage and additional pressure on healthcare. The project is not considered to be	N/A	No

Major event		Relevance to the project	Potential receptors	Include in shortlist?
		vulnerable or a potential contributor to drought.		
3.5	Lightning strikes	There are several new structures being constructed. However, the risk is not considered to be any greater than any other road structure.	N/A	No
3.6	Hailstorm	Hailstorms could cause adverse conditions on the project, causing accidents, slow moving traffic or traffic delays. However, the risk to the project is considered no greater than the current A66. Consideration should be given to changing conditions due to climate change and the project will be designed to account for this.	N/A	No
3.7	Heatwaves	Heatwaves are considered a disaster when high temperatures last several weeks, harming people's health. This can cause fatalities amongst vulnerable groups, environmental damage and additional pressure on healthcare. The project is not	N/A	No

Major event		Relevance to the project	Potential receptors	Include in shortlist?
		considered to be vulnerable or a potential contributor to heatwaves.		
3.8	Low (sub-zero) temperatures	Winter temperatures are projected to increase between 1-5 degrees (2070-2099) from current levels due to climate change. This can cause fatalities amongst vulnerable groups, environmental damage and additional pressure on healthcare. The project is not considered to be vulnerable or a potential contributor to low temperatures.	N/A	No
3.9	Tornadoes	Although tornadoes have been known to occur in the UK, their destructive force is less than that in other parts of the world. The project is not considered more vulnerable to tornadoes than the existing A66 or any other development, nor will the project contribute to the hazard of tornadoes.	N/A	No
3.10	Wildfires	There is potential for scrub, grassland or heathland fires,	Road users Infrastructure Ecology	No

Major event		Relevance to the project	Potential receptors	Include in shortlist?
		especially given the expected increase in temperatures and heatwaves associated with climate change. The project is considered no more vulnerable than the existing A66, and the expected reduced accident rate due to improved traffic flow will reduce potential wildfire sources.	Environment & landscape Residents	
3.11	Air quality events	Vehicle emissions can contribute to poor air quality, and smog can be induced by weather events - temperature inversions - 'trapping' pollution. These events are more likely in dense urban areas with multiple sources of pollution and are unlikely to occur along the A66.	N/A	No
4	Space disasters			
4.1	Impact events and airburst	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
4.2	Solar flare	Solar flares can interrupt radio and other electric communications. There is no specific increased reliance	Motor vehicles Electrical infrastructure	No

Major event		Relevance to the project	Potential receptors	Include in shortlist?
		on new roadside technology that would result in the project being any more vulnerable to solar flare than the existing A66.		
5	Transport			
5.1	Road accidents	A driving factor for the project is to increase safety on a road that has an above-average accident rate. Although the aim of the project is to increase traffic flow and hence reduce accidents, there is still the potential for fatal accidents. There is also a risk posed by spillage from hazardous loads as a result of a road traffic accident. This risk is unlikely to increase due to the project.	Road users Infrastructure	Yes
5.2	Rail accidents	No railways located within the study area directly interface with the project.	N/A	No
5.3	Aircraft disasters	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
5.4	Maritime disasters	Not applicable as the site is not in a coastal location.	N/A	No
6	Engineering accidents/failures			

Major event		Relevance to the project	Potential receptors	Include in shortlist?
6.1	Bridge collapse or failure	There are structures in the project that could be at risk of collapse, including the overbridge and underbridge crossings and retaining walls.	People Infrastructure Road users	Yes
6.2	Tunnel collapse or failure	There are no tunnels designated into the project.	N/A	No
6.3	Dam failure	There are no dams in the study area.	N/A	No
6.4	Flood defence failure	There are no formal flood defences in the study area that directly interface with the project.	N/A	No
6.5	Mast and tower collapse	There are radio communication and telecommunication masts in the study area.	Infrastructure Businesses Emergency services Residents	Yes
6.6	Building failure or fire	There is the potential for building collapse during the demolition phase.	People Property Infrastructure	Yes
6.7	Temporary structure failure	There is the potential for temporary structure failure during the construction of elements of the project. This could be due to inclement weather, an infrastructure strike by road traffic or a lack of maintenance of temporary structures during construction.	People Infrastructure Road users	Yes

Major event		Relevance to the project	Potential receptors	Include in shortlist?
6.8	Utilities failure (gas, electricity, water, sewage, oil communications)	There are electricity and water utility pipes beneath the project. A cable strike or damage to one of the utilities could cause electrical failure, cut off radio communication, flooding, or a fire or explosion.	Electrical infrastructure Emergency services Residents Businesses	Yes
6.9	Pollution of watercourses	Construction activities close to an existing watercourse. Risk of of earthworks drainage causing fouling due to carbonate deposits can lead to pollution of watercourses.	Environment Waterways Environment and ecological habitats	Yes
6.10	Demolition contamination	Tar is potentially present in existing pavement layers. Tar is a carcinogenic hazardous waste which was used to bound pavements and carriageways before the 1980s. There are therefore restrictions on how the waste is handled and disposed of. The construction of the project will involve breaking out some of the existing pavement. Disturbance of the pavement can realise fumes and the material itself is	People Environment Waterways	Yes

Major event		Relevance to the project	Potential receptors	Include in shortlist?
		carcinogenic. If this waste is not handled correctly, it may be improperly disposed of, leading to contaminations events through leaching.		
7	Industrial accidents (historical and existing risks)			
7.1	Defence industry/military accidents	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
7.2	Energy industry (fossil fuel)	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
7.3	Nuclear power	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
7.4	Oil and gas refinery/ storage	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
7.5	Food industry	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
7.6	Chemical industry	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No

Major event		Relevance to the project	Potential receptors	Include in shortlist?
7.7	Manufacturing industry	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
7.8	Mining industry	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
8	Terrorism/Crime/Civil unrest			
8.1	Bomb/vehicle attack on people	Possible that the structures could be a target for a terrorist attack. There is a Ministry of Defence training centre located along the A66 which increases the risk.	Road users Infrastructure	Yes
8.2	Bomb/vehicle attack on infrastructure	Possible that the structures could be a target for a terrorist attack.	Road users Infrastructure	Yes
8.3	Mass shooting	Unlikely to be a target for this type of incident due to the low number of exposed targets.	N/A	No
8.4	Chemical/gas attack	Unlikely to be a target for this type of incident due to the low number of exposed targets.	N/A	No
8.5	Rioting	Unlikely to occur in a rural location. The project is not considered more vulnerable than the existing A66.	N/A	No
8.6	Cyber attacks	Increasing reliance on roadside technology could	Road users Electrical	Yes

Major event		Relevance to the project	Potential receptors	Include in shortlist?
		render the project more vulnerable to a cyber-attack.	Infrastructure	
9	War			
9.1	Conventional	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
9.2	Chemical	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
9.3	Nuclear	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
10	War			
10.1	Human	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
10.2	Animal	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No
10.3	Plant	The project is considered no more vulnerable than the existing A66 or any other development.	N/A	No

Based on the initial assessment presented in Table A-18-1 the following potential major event types were selected for further consideration in the shortlist:

- Slope instability, including landslides and rock falls
- Sinkholes

- Flooding
- Road accidents
- Structural failure (i.e. bridge collapse, mast and tower collapse, etc.)
- Utilities failure (gas, electricity, water, sewage, oil communications)
- Pollution of watercourses
- Demolition contamination
- Bomb/vehicle attack on people or infrastructure
- Cyber attacks

A disaster is defined as a naturally occurring phenomenon such as an extreme weather event (e.g. storm, flood, temperature) or ground-related hazard events (e.g. subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a major event.

Stage 2: Shortlist screening

A screening exercise was undertaken to review the longlist of major events and to consider their relevance to the project, and whether they should be given further consideration.

- In line with guidance from the IEMA risks were screened out if:
- There is no source-pathway-receptor linkage.
- The receptor is not within the scope of the assessment.
- The likelihood and consequences are as follows:
  - high likelihood/high consequence – this is considered unreasonable to the project and therefore is assumed designed out or managed;
  - low likelihood/low consequence – this does not constitute a major event and therefore can be screened out; and
  - high likelihood/low consequence – this does not constitute a major event and therefore can be screened out.
- The consequence does not meet the criteria of a significant environmental effect, and therefore the risk is not a potential major event.
- The consequence and likelihood of the risk is so high as to be unacceptable and has therefore been designed-out or otherwise managed.

For each major event, the shortlist details:

- A description of the relevance of the risk event to the project.
- The potential receptors.
- The relevant phases of the project the event could affect.
- The environmental receptor category or categories that could be impacted if the major event were to occur.
- The reasonable worst-case consequence if the major event were to occur.
- Any mitigation for the major event currently embedded within the project through legislation, standards, policy and other measures.
- A conclusion on whether each risk will be considered further throughout the design process. If a risk is already managed to ‘as low as reasonably practicable’, they are not assigned to be considered further. The results of this further investigation will be reported in the relevant chapters of the ES.

The level of consequence of the risk of a major event was determined through several factors to identify potentially significant effects. These are:

- The geographic extent of the effects. Effects beyond the project boundaries are more likely to be considered significant.
- The duration of the effects. Effects which are permanent (i.e. irreversible) or long lasting are more likely to be considered significant.
- The severity of the effects in terms of number, degree of harm to those affected and the response effort required. Effects which trigger the mobilisation of substantial civil emergency response effort are more likely to be considered significant.
- The sensitivity of the identified receptors.
- The effort required to restore the affected environment. Effects requiring substantial clean-up or restoration efforts are more likely to be considered significant.

The shortlist is presented in Table A-18-2 including details how these major events types are considered during the design development for the project, and where the findings of further assessment and mitigation, where relevant, will be reported.

Table A-18-2: Shortlist

Major event		Further consideration required?	Where addressed?	Likely significant effects?
Natural disasters				
1	Geological disasters			
1.1	Slope instability, including landslides and rockfall	Yes. Slope instability that may impact the project could have health and safety consequences for road users, maintenance workers and potentially damage existing infrastructure. Design of slopes and rockfall protection measures will be developed in accordance with CD622 Managing Geotechnical Risk with the aim of mitigating the occurrence and severity of slope instability. This will manage the risk both in terms of the	Design, mitigation and monitoring to be detailed in the Geotechnical reporting in accordance with CD622 Managing Geotechnical Risk. Where relevant, mitigation measures will be included in the Environmental Management Plan (EMP).	No

Major event		Further consideration required?	Where addressed?	Likely significant effects?
		vulnerability of the project to these types of event, and in terms of the potential for the Project to increase the risk of such an event happening. Structures will be designed in to meet the requirements of all relevant standards including consideration of environmental conditions resulting from climate change.		
1.3	Sinkholes	Yes. The risk will be managed in accordance with CD 622 Managing Geotechnical Risk and will be assessed based on the ground investigation and considered during design development where appropriate.	Design and mitigation to be detailed in the Geotechnical reporting in accordance with CD 622 Managing Geotechnical Risk. Where relevant, mitigation measures will be included in the EMP	No
2	Hydrogeological disasters			
2.1	Flooding	Yes. Flood Risk Assesment (FRA) of Project to be understaken and an EMP will be prepared for the project. The project will be designated to cope with new ranges of precipitation and temperature	FRA and Chapter 15: Road Drainage and the Water Environment. Where relevant, mitigation measures will be included in the EMP	No

Major event		Further consideration required?	Where addressed?	Likely significant effects?
3	Meteorological disasters			
-	-	-	-	No
4	Space disasters			
-	-	-	-	No
5	Transport			
5.1	Road accidents	No. The project aims to reduce accident rates.	Road Safety Audits Safety Appraisal in the Economic Assessment Where relevant, mitigation measures will be included in the EMP	No
6	Engineering accidents/failures			
6.1	Structural failure (i.e. bridge collapse)	Yes. Ensure structures are designed and maintained in accordance with standards and with taking account of environmental conditions including climate change. It is necessary to ensure maintenance activities are undertaken for the lifetime of the structure.	CDM Risk Register, Project Risk Register and as part of design Where relevant, mitigation measures will be included in the EMP	No
6.5	Mast and tower collapse	No. Not considered to be a risk as these can be designed out of the project.	N/A	No
6.6	Building failure or fire	No. Will be appropriately managed and mitigated by competent	CDM Risk Register, Project Risk Register and as part of design	No

Major event		Further consideration required?	Where addressed?	Likely significant effects?
		contractors adhering to CDM and construction planning.	Construction Method Statement Where relevant, mitigation measures will be included in the EMP	
6.7	Temporary structure failure	No. Will be appropriately managed and mitigated by competent contractors adhering to CDM and construction planning. Structures are designed in accordance with design codes and with consideration of environmental conditions including climate change.	CDM Risk Register, Project Risk Register and as part of design Buildability Report Construction Method Statement Where relevant, mitigation measures will be included in the EMP	No
6.8	Utilities failure (gas, electricity, water, sewage, oil communications)	No. There will be back up generators and the risk will be appropriately managed and mitigated by design and competent contractors adhering to CDM and construction planning.	Statutory Undertakers Report Where relevant, mitigation measures will be included in the EMP	No
6.9	Pollution of watercourses	Yes. Mitigation measures will be required.	Chapter 13: Road Drainage and the Water Environment Where relevant, mitigation measures will be included in the EMP	No

Major event		Further consideration required?	Where addressed?	Likely significant effects?
6.10	Demolition contamination	Yes. Encountering tar in pavements is common for all roads constructed before the 1980s and there are codes and best practices to minimise the risks. Contractors will be expected to apply hazardous waste procedures and protect workers with the use of appropriate Personal Protective Equipment (PPE).	Buildability Report Construction Method Statement Where relevant, mitigation measures will be included in the Environmental Management Plan	No
7	Industrial accidents (historical and existing risks)			
-	-	-	-	No
8	Terrorism/Crime/Civil unrest			
8.1	Bomb/vehicle attack on people	No. There is considered to be no greater risk of these major events as a result of the project compared to any other road within the highways network; therefore, this does not need to be considered further. Infrastructure is designed in accordance with design codes and in consultation with the relevant authorities.	N/A	No
8.2	Bomb/vehicle attack on infrastructure		N/A	No
8.6	Cyber attacks		N/A	No

Stage 3: shortlist

Where further design mitigation is unable to remove the potential interaction between a major event and a particular topic, the relevant ES chapter would be required to identify the potential consequence for receptors covered by the topic and give a

qualitative evaluation of the potential for the significance of the reported effect to be increased as a result of a major event.

All of the events on the shortlist relate to matters for design and are covered by existing design requirements, standards such as DMRB, specifications or health and safety legislation (e.g. slope instability, structural failure), or are considered further within other aspects of the EIA (e.g. flood risk, pollution control).

Conclusion

On the basis of the assessment presented here, there are not considerered to be any likely significant environmental effects from major events that are not already adequately addressed in the design and elsewhere in the EIA.

All events identified will continue to be reviewed with the design team to ensure the risks are understood and addressed through design as necessary.

This topic is therefore proposed to be scoped out. No specific further consideration of major events is therefore proposed to be included as part of the EIA.

Assumptions and exclusions

There is no recognised standard methodology for the assessment of major events. A number of methodologies have been presented such as the *DMRB LA 104 Environmental Assessment and Monitoring* (Highways England, 2020)[253] and the IEMA guidance previously referred to. This together with professional judgement and experience has been used to undertake and inform the assessment.

The risk registers used to compile the longlist were assumed to be current and correct at the time of producing the longlist.

It is considered reasonable to exclude certain receptor groups from the outset. Construction workers, as a receptor, have been excluded from the assessment, because existing legal protection is considered to be sufficient to reduce any risk from major events to a reasonable level. Legislation in force to ensure the protection of workers in the workplace includes:

- *Construction (Design and Management) (CDM) 2015 Regulations (as amended)*
- The *Management of Health and Safety at Work Regulations 1999 (as amended)*
- The *Workplace (Health, Safety and Welfare) Regulations 1992 (as amended)*
- *Health and Safety at Work etc. Act 1974 (as amended)*

Another potential source of major events related to the project is road traffic accidents during its operation. These can clearly impact on people though fatalities and serious injury, but can also impact on the environment, through the spillage of fuel and hazardous loads. However, for the project, it is anticipated that there will be an overall reduction in the number of incidents.

As such, although the EIA will still consider the risk of spillages, as part of the assessment of road drainage and the water environment, the potential for such

[253] Highways England (2020b) Environmental Assessment and Monitoring LA 104, available at: https://www.standardsforhighways.co.uk/dmrb/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a

incidents to affect people, as receptors under the topic of human health, is not considered further.

Major events considered at the earliest stage to be irrelevant to the project are excluded from the longlist, for example military incidents.