CONTENTS

FIGURES

APPENDICES

None

3 Alternatives

3.1 Introduction

3.1.1 This chapter describes the alternatives that have been considered throughout the project development process and how environmental impacts have been considered to inform the decision-making process. Further detail about the process, the alternatives considered, and the wider factors that have informed the decision-making is set out in the *A66 Northern Trans-Pennine Route Development Report* (Highways England, 2021)[1].

3.2 Project History

3.2.1 In 2014, the government announced that it intended to examine the case for dualling one of the routes across the Pennines in the north of England. In 2017, it was announced that the A66 had presented the strongest case for an 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.

3.3 Overview of Option Selection Process

3.3.1 Image 3-1: Options identification and selection process, presents the overall option development and appraisal process which was undertaken for the A66 during option identification and option selection stages, and the process currently being undertaken as part of preliminary design.

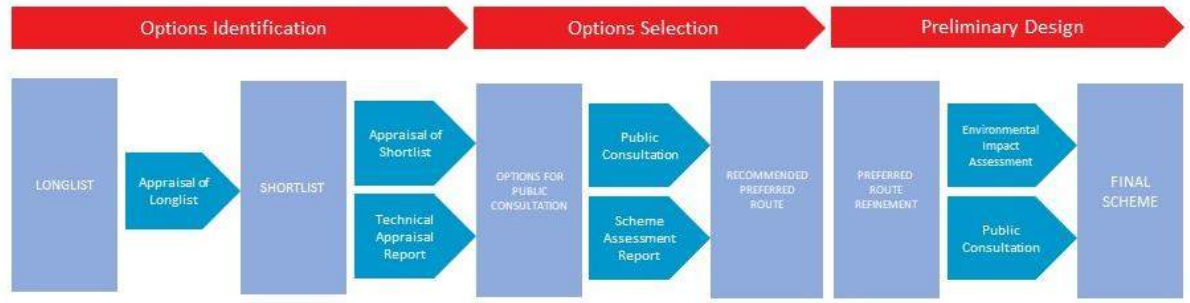

Image 3-1: Options identification and selection process

3.3.2 The process of options identification, options selection and preliminary design undertaken to date and leading to the project as it is described in Chapter 2: The Project, has followed the following stages:

- Options identification stage comprising a longlist appraisal undertaken in February 2018 and a shortlist assessment completed in November 2018
- Options selection stage to examine and refine shortlisted routes which were then taken to non-statutory public consultation in summer 2019
- Refining of route options, incorporating comments from consultation and the selection of a preferred route which was announced in May 2020
- Preliminary design comprising further design development of the preferred route and additional appraisal of alternative alignment routes.

[1] The Route Development Report is available as part of the consultation material at: http://www.highwaysengland.co.uk/A66-NTP

3.3.3 The potential impact on the environment of each of the options has been an important consideration throughout the option identification and selection process, and has been a key influence in decision making.

3.3.4 The public consultation in summer 2019 presented the route as seven sections with a total of 15 options. A summary of the options is presented in the A66 Northern Trans-Pennine Project Options Consultation Report (Highways England, 2020a)[2] available at: https://highwaysengland.citizenspace.com/cip/a66-northern-trans-pennine/results/options_consultation_report_aw_lo_res.pdf

3.3.5 Details of the preferred route, the results of the public consultation, and main reasons for the selection of the preferred route are presented in the A66 Northern Trans-Pennine Project Preferred Route Announcement (Highways England, Spring 2020)[3] available at: https://highwaysengland.citizenspace.com/cip/a66-northern-trans-pennine/results/pra_report_aw_lo_res.pdf. This is also set out in the A66 Northern Trans-Pennine Project Scheme Appraisal Report (Highways England, 2020b).

3.3.6 Subsequent to the Preferred Route Announcement (PRA) 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. Project Objectives are outlined in Chapter 2: The Project.

3.3.7 Detail of the options considered at previous stages and the key factors that have influenced the option development and selection of the preferred route are set out in the *A66 Northern Trans-Pennine Route Development Report* (Highways England, 2021)[4].

3.3.8 Further to the announcement of the preferred route, further work and refinement has been undertaken as part of the ongoing preliminary design stage. This has included further development of the design of the preferred route, as well as the identification of alternative alignment routes developed in response to further work undertaken to understand the baseline environment and having regard to engagement responses.

3.4 Design Refinements

3.4.1 Design refinements to the preferred route and the works at the A1(M) at Scotch Corner considered to date as part of the preliminary design stage are summarised below in Table 3-1: M6 Junction 40 to Kemplay Bank: Design refinements since the option selection stage, to 3-5: A1(M) Junction 53 Scotch Corner: Key design changes since the option selection stage. The full range of environmental factors were considered when assessing the differences between alternatives, alongside a full range of other factors (e.g. buildability, cost, policy and legislation, community and stakeholders).

[2] Highways England (2020a) A66 Northern Trans-Pennine Project Options Consultation Report, available at: https://highwaysengland.citizenspace.com/cip/a66-northern-trans-pennine/results/options_consultation_report_aw_lo_res.pdf [accessed 13 September 2021]
[3] Highways England (2020b) A66 Northern Trans-Pennine Project Preferred Route Announcement https://highwaysengland.citizenspace.com/cip/a66-northern-trans-pennine/results/pra_report_aw_lo_res.pdf [accessed 13 September 2021]
[4] Highways England (2021) Route Development Report, available as part of the consultation material on http://www.highwaysengland.co.uk/A66-NTP

3.4.2 These tables focus on highlighting the environmental factors that were differentiators between alternatives as part of these design refinements and how they have factored in the decision making. In order to determine the potential environmental impacts, the PRA route was used as a baseline against which professional judgement was used to compare the impacts of potential alternatives. This comparison was utilised to determine whether the baseline or the alternative was preferable in each case.

3.4.3 It should be noted that while these environmental factors were taken into account as part of the design process, they may not have been the determining factor in the final decision. Table 3-1 to 3-5 summarise the key factors that have informed the decision making (including environment but also other factors), and full details on the decision-making process for each scheme, stakeholder engagement and the engineering and buildability factors that informed the final decision for these design decisions can be found in the *A66 Northern Trans-Pennine Route Development Report*[1].

M6 Junction 40 to Kemplay Bank

Table 3-1: M6 Junction 40 to Kemplay Bank: Design refinements since the option selection stage

Junction/ Area Name	Reason for Review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors that differ between alternatives	Outcome of Review
M6 J40	The preferred route design proposed recognised that improvements might be required to J40 of the M6 further traffic modelling was undertaken which identified the need to upgrade this junction.	In order to upgrade, two possible designs were considered. One of these was comprised of widening to both bridges over the M6 J40 to support additional lanes. The other alternative was a combination of improvements to traffic signal arrangement, widening of slip roads and use of spiral road markings in order to achieve the required traffic improvements.	Environmental topics considered to have differing impacts between the alternatives considered were: Climate, Air Quality, Noise, and Population and Human Health. Avoiding having to widen the bridge structures would result in fewer resources having to be used and lower GHG emissions. It also limits the disturbance to the local community and road users and reduces noise and air quality impacts.	Environmental factors were considered alongside preliminary traffic modelling and it was determined that widening the bridges would not achieve a significant improvement in traffic flow compared to the potential environmental impact. Widening the bridges was not progressed and the alternative proposals are included in the design.
Emergency Services Site to the south east of Kemplay Bank Roundabout	The proposed underpass beneath the Kemplay Bank roundabout would require the removal of an existing A66 underpass that is a critical connection from Carleton Avenue into the emergency services compound, which was highlighted as a key risk for the emergency services. A	Multiple design alternatives were considered including an overpass over the new road, a replacement underpass further to the east of the location of the existing, or a single access of the new roundabout. An alternative was developed involving a reduction in the speed limit to 50mph to	Environmental topics considered to have differing impacts between the alternatives considered were: Air Quality, Noise, Water Environment, Biodiversity, Landscape, and Climate. A comparison was made between the potential impacts of the alternatives and determined that construction of a	Traffic modelling, stakeholder engagement and environmental assessment were taken into considered and it was determined that the proposal to reduce the speed limit to 50mph through this section of the A66 had

Junction/ Area Name	Reason for Review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors that differ between alternatives	Outcome of Review
	replacement connection would be required to maintain this connectivity.	allow the proposed Kemplay Bank roundabout underpass alignment to be adjusted to retain the existing access.	replacement underpass or a new overbridge would have impacts on local ecology and landscape, while reducing the speed limit to 50mph could lead to localised improvements to air quality and noise, and would avoid the GHG emissions associated with the construction of a replacement underpass or new overbridge structure.	the most benefit. and it was determined that reduction of the speed limit was the alternative that would be implemented, allowing the retention of the existing underpass in its current location.

Penrith to Temple Sowerby

Table 3-2: Penrith to Temple Sowerby: Key design changes since the option selection stage

Junction/ area name	Reason for Review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors	Outcome of Review
Local landowner accommodation Overbridge	The preferred route design proposed to close the existing gap in the central reservation which a local landowner uses and which would cut off the landowner's access to their land on the northern side of the A66. Access for the landowner was not considered in the Option Identification Stage and this alternative arose	In order to maintain connectivity for this landowner two alternatives were considered in the form an overpass or an underpass.	Environmental topics considered to have differing impacts between the alternatives considered were: Cultural Heritage, Biodiversity, Water Environment, Landscape, and Climate. Both alternatives encroached on a Scheduled Monument, but the underpass was considered likely to have caused a greater impact on buried archaeology. The location of the proposed	The environmental factors were taken into consideration alongside stakeholder engagement, and engineering and buildability factors and on balance it was determined that the overbridge was considered to have the lesser environmental impact overall, and from

Junction/ area name	Reason for Review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors	Outcome of Review
	following further consultation with the landowner.		underpass was much closer to the River Eamont which forms a part of the River Eden SAC and SSSI which was considered to have an increased risk of impacts to ecology and water quality. The overbridge was considered to result in a greater change of setting and visual impact, however the existing embankments were likely to limit some of the impact. The overbridge was considered to have an increased climate impact due to the greater resource requirement compared to the underpass.	a design perspective was considered to have improved buildability compared to an underpass. The baseline of no access was considered unacceptable due to impacts to local stakeholders.
High Barn	The Option Identification Stage alignment was routed south of High Barn (to avoid buildings). However, from discussions with the landowner it became clear that it would be beneficial to them if the alignment was moved north to lessen impacts on their land and instead to take down the buildings.	Move alignment north of High Barn to take down the buildings.	Environmental topics considered to have differing impacts between the alternatives considered were: Air Quality, and Population and Human Health. The alternative would lead to greater demolition impacts (e.g. dust, waste etc) but would retain and protect agricultural land in line with the wishes of the landowner.	Following stakeholder engagement, and consideration of environmental factors, and engineering and buildability, it was determined that the mainline alignment was to be moved north (closer to the existing A66), which creates better horizontal

Junction/ area name	Reason for Review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors	Outcome of Review
				geometry and is also beneficial for the landowner as less land take is required.
Center Parcs	Following the decision to move the mainline alignment north at High Barn, a review of the grade-separated junction arrangement at the Centre Parcs junction to better fit the new alignment and minimise land take was undertaken.	Reorientate ('flip') the separated junction layout.	Environmental topics considered to have differing impacts between the alternatives considered included: Biodiversity, and Population and Human Health. Alternative layout was determined to required less land take and the thereby avoids impacts to habitats and local landowners.	Following consideration of environmental factors, The junction arrangement/orientation was updated to minimise land take.
Winderwath Estate	Discussions with the landowner yielded preferences for access arrangements and accommodation tracks to provide better links to their land.	Requirement for a new structure to facilitate access - accommodation (i.e. private access) overbridge and underpass and associated tracks were considered.	Environmental topics considered to have differing impacts between the alternatives considered were: Cultural Heritage, Landscape, Population and Human Health, and Climate Increased GHG emission and material use associated with additional structure compared to the baseline of not providing the additional access. Both underpass and overbridge alternatives provide greater connectivity for the local	The decision was taken to provide the additional access, and the overbridge alternative with associated linked tracks was selected for inclusion in the design.

Junction/ area name	Reason for Review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors	Outcome of Review
			landowner. The underpass would create a greater risk of potentially disturbing buried archaeology. The overbridge would have a greater visual impact and would need to be sympathetic to its surroundings	

Bowes Bypass

Table 3-3: Bowes Bypass: Key design changes since the option selection stage

Junction/ Area Name	Reason for review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors	Outcome of Review
Western extents of scheme	The preferred route alignment had a minor encroachment into the North Pennines AONB. A core principle adopted for the scheme was the aim to develop a route that could be constructed outwith the North Pennines AONB, in accordance with the National Networks National Policy Statement. Following a detailed design review from both an environmental and engineering perspective however, it was determined that the preferred route could not be constructed	The alternative considered would move the alignment approximately 4m to the north at its maximum betwee n Clint Lane Bridge and the western scheme extent so that the southern kerb line matches the existing kerbline over the extent of	Environmental topics considered to have differing impacts between the alternatives considered were: Biodiversity, landscape and population. The alternative would require more land take to the north of the alignment. Thereby increasing potential impacts upon deciduous woodland and agricultural land in comparison with the preferred route design. The alternative does not fall within the boundary of the AONB and is therefore preferred with regards to the policy tests set out	The environmental factors were taken into consideration alongside engineering and buildability factors and on balance the assessment concluded that the Preferred Route should be progressed, as the additional work required to avoid widening into the AONB would be disproportionate, and the broader environmental effects greater, compared to the minor road widening and verge works required of the Preferred Route design. It is

Junction/ Area Name	Reason for review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors	Outcome of Review
	without land take within the AONB along a length of 80m, encroaching into the AONB by a maximum of 1.8m at the western tie-in. Hence it was determined that further work was required to identify whether there was a suitable alternative to this alignment completely outwith the AONB.	the AONB.	in the NPSNN (5.151 and 5.152. However with regards to DMRB LA 107 the change will be too small to affect key qualities of the designation and overall the environmental impacts of the alternative outside the AONB are greater.	acknowledged that the Preferred Route will encroach in to the AONB. Based on design assessments and feedback from Natural England and AONB Partnership an exceptional circumstances case will be put forward to support the incursion.

Stephen Bank to Carkin Moor

Table 3-4: Stephen Bank to Carkin Moor: Key design changes since the option selection stage

Junction/ Area Name	Reason for Review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors	Outcome of Review
Moor Lane	Following feedback from the local parish council concerning the use of Moor Lane for through traffic and safety concerns following a design review	Three alternatives were considered to discourage the use of Moor Lane for through traffic and to improve safety. Blue route: 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. Green route: Provision of a new grade-separated all movement	Environmental topics considered to have differing impacts between the alternatives considered were: biodiversity, landscape and visual, road drainage and water environment, cultural heritage, agricultural land, noise and vibration, population, waste and Climate Change. Blue route - impacts upon woodland/ hedgerows and watercourse crossings. Carbon impacts due to increased structures. Potential effects upon Foxwell and Foxgrove Farms.	The environmental factors were taken into consideration alongside stakeholder engagement, safety engineering and buildability factors and on balance it was determined that the Green route would be taken forward, this being the preferred

Junction/ Area Name	Reason for Review of Option Selection Stage Design	What Alternative was Considered?	Environmental Factors	Outcome of Review
	regarding the junction being located opposite Mainsgill farm.	junction to the western boundary of the existing alignment of Moor Lane, providing connectivity between the de trunked A66 and the proposed mainline. Orange route: West facing slip roads at Collier Lane and east facing slip roads at Moor Lane.	Green route- potential improvements in terms of biodiversity, landscape, heritage and WCHAR. Potential impacts in terms of carbon, soil, waste and noise and vibration. Orange route – Potential impacts upon woodland/ hedgerows, carbon, waste, agricultural land and noise and vibration.	alternative from an engineering and environmental perspective.

A1(M) Junction 53 Scotch Corner

Table 3-5: A1(M) Junction 53 Scotch Corner: Key design changes since the option selection stage

Junction/ area name	Reason for inclusion since Option Selection Stage design	What alternative was considered?	Environmental factors	Outcome of review
Middleton Tyas Lane approach	The preferred route design proposed recognised that improvements might be required to Junction 53 of the M1. Further traffic modelling was undertaken which identified the need to upgrade this junction.	High-level capacity assessments had been carried out that confirmed the existing junction would not provide adequate capacity in its current form once the A66 project is built. The initial proposal assumed works would be required across all arms of the junction. Further traffic modelling was then carried out to verify the extent of change which would be required, including sensitivity testing relating to new developments. Following the modelling the scheme was refined to focus on the accessibility of the junction from the Middleton Tyas arm, including from the existing motorway services.	Potential impacts upon existing bank of trees and hedgerow adjacent to the junction, though refined proposal has relatively small footprint.	Based on the traffic modelling, the widening of the Middleton Tyas Lane approach to the A1(M) Junction 53 at Scotch Corner roundabout, from one lane to two lanes is being taken forward

3.5 Development of Alternative Route Alignments

3.5.1 In parallel with the design refinements, a number of alternatives that deviate from the preferred route have also been developed and assessed for a number of the schemes. This process, and the reasons for it, is described in detail in the *A66 Northern Trans-Pennine Route Development Report (Highways England, 2021)* [1], and a summary of the key environmental aspects of this process have been summarised below.

3.5.2 Those schemes for which alternatives have been identified that deviate from the preferred route are as follows:

- Temple Sowerby to Appleby
- Appleby to Brough
- Cross Lanes to Rokeby.

Temple Sowerby to Appleby

3.5.3 Following a detailed design review from both an environmental and engineering perspective, it was considered that the preferred route could have significant negative impacts on the Trout Beck watercourse which is both nationally and internationally designated as part of the River Eden SAC/SSSI as a result of embankments leading to a disconnection of the floodplain of the watercourse. In order to avoid these as far as possible, it was agreed with key regulators that an open span crossing would be implemented, to minimise any risk of impact on geomorphology of the site. Because of the location of the crossing of the preferred route, this would result in an 800m open span structure across the floodplain. Whilst a feasible design was developed, this led to a number of concerns about buildability, effect of shading of the watercourse, risk of impact on the protected site during construction, cost and materials (and carbon) use, therefore a number of alternatives were considered to shorten the crossing. The key focus when developing the alternatives was to reduce the impact of the crossing on the Trout Beck, and ultimately on the SAC.

3.5.4 15 alternatives were developed and shortlisted taking into account potential environmental impacts, project design principles, impacts on landowners, buildability and design safety. This process is detailed further in Section 5.5.34 of the *A66 Northern Trans-Pennine Draft Route Development Report* (Highways England, 2021)[1]. The 15 alternatives are as shown in Figure 3.1: PCF 3 Long List Route Options for Temple Sowerby to Appleby. From these 15 alternatives, 10 were eventually discounted due to the following summary points:

- Alternatives to the south of the River Eden were unviable due to the number of watercourse crossings required, and as a consequence of the resultant routes being too long to be considered cost effective.
- Alternatives through, or involving junction works over, the area underlain by gypsum mines were discussed but considered to pose unacceptable geotechnical risks when compared to alternative solutions.

3.5.5 The five alternatives that were not discounted at this stage were:

- Black route – original preferred route, as announced in May 2020.
- Blue route – evolved preferred route, with an eastern Trout Beck crossing point.
- Green route – evolved preferred route, with a western Trout Beck crossing point.
- Red route – eastern alternative, closer to the boundary of the gypsum mineworkings, but with the shortest crossing Trout Beck.

- Orange route – online alternative.

3.5.6 Following further review, the Green route was discounted due to its proximity to Kirkby Thore and potential impact on the nearby Scheduled Monument, and the Black route was deemed to have no substantial benefit over the Blue route when the views of key regulators were taken into account.

3.5.7 The three remaining (Red, Blue and Orange) alternatives, required further design consideration and environmental assessment in order to determine the best alternative and are described in Chapter 2: The Project and shown in Figure 2.3: Temple Sowerby to Appleby. At the time of writing, these three alternatives remain under consideration and are subject to assessment within this PEI Report.

Environmental review of alternatives

3.5.8 Table 3-6: Key environmental differences between alternatives considered at Temple Sowerby to Appleby, outlines the key environmental differences between these remaining alternatives. Only material differences between the routes have been included in this table, however all three alternatives are assessed within each topic chapter in this PEI Report. Additionally, the information in this table is a brief summary of the material differences, there may be additional constraints or opportunities described in further detail in the relevant topic chapter.

3.5.9 As set out in Chapter 2: The Project, we have considered the options outlined and our preferred route for this scheme is the Blue alternative. The full reasons for this selection are outlined in more detail in the *A66 Northern Trans-Pennine Route Development Report* (Highways England, 2021)[1] which sets out and summarises the environmental, policy and other factors leading to route selection.

Table 3-6: Key environmental differences between alternatives considered at Temple Sowerby to Appleby

Topic	Red Alternative	Blue Alternative (Evolved version of the Preferred Route announced in Spring 2020)	Orange Alternative
Air Quality (PEI Report Chapter 5)	No material differences between these alternatives identified.		
Biodiversity (PEI Report Chapter 6)	Similar to the Blue Alternative with the addition of shading effects on Keld Syke, greater loss of and greater loss and severance impacts to Chapel Wood.	Potential for adverse effects on River Eden SAC and River Eden and Tributaries SSSI, and several county wildlife sites, relating to habitat loss. There may also be adverse effects on ancient woodland, ponds, hedgerows, and open mosaic habitat due to loss or fragmentation. Potential adverse effects on bat roosts and bat activity, barn owls, amphibians, reptiles, terrestrial invertebrates and macrophytes, red squirrel and other terrestrial mammal species due to habitat loss and fragmentation.	Similar to the Blue Alternative with the addition of greater risk of construction impact to the River Eden, greater potential for tree loss and localised impact to Temple Sowerby SSSI.
Climate (PEI Report Chapter 7)	As the longest of the alternatives, this may result in greater Green House Gas impact than Blue or Orange. The structure required to cross Trout Beck is at risk of scour.	May have a greater Green House Gas impact than Orange as it is longer, but a lesser impact than Red as it is shorter. The structure required to cross Trout Beck is at risk of scour.	As the shortest of the alternatives, this is likely to result in lower Green House Gas impact than Red or Blue. This alternative has a reduced risk of being affected by wildfires due to its urban setting. Structure to cross Trout Beck is at risk of scour.
Cultural Heritage (PEI Report Chapter 8)	Avoids land take from the Scheduled Monuments in the vicinity of Kirkby Thore.	Requires land take in close proximity to the Roman camp 350m east of Redlands Bank Scheduled Monument which geophysical survey has identified as containing	Likely significant effect on the Kirkby Thore Roman Fort and Associated Vicus Scheduled Monument south of the existing A66 through direct land

Topic	Red Alternative	Blue Alternative (Evolved version of the Preferred Route announced in Spring 2020)	Orange Alternative
		features associated with the Scheduled Monument.	take, and land take in proximity to the Roman camp 350m east of Redlands Bank Scheduled Monument which geophysical survey has identified as containing features associated with the Scheduled Monument.
Geology and Soils (PEI Report Chapter 9)	Impacts to agricultural soils and soils supporting SAC and SSSI designations.	Impacts to agricultural soils and soils supporting SAC and SSSI designations.	Impacts to agricultural soils.
Landscape and Visual Effects (PEI Report Chapter 10)	Constructed offline from the existing A66 residents of Kirkby Thore are similar to the Blue Alternative but potentially greater impacts on Long Marton. The structure required to cross Trout Beck may be as tall as 18m, making it a potentially significant feature of hard engineering in the otherwise rural landscape. Requirement for additional comments of Keld Syke.	Constructed offline from the existing A66 will affect landscape character around Kirkby Thore as a result of new infrastructure, alteration of field patterns and realignments of road network and PRoW network. Increased views of road related infrastructure from Kirkby Thore.	Construction of connector roads will affect the surrounding field patterns. Property demolition required for this Alternative Route may open up views towards additional infrastructure from PRoW. Localised visual change will result from watercourse crossing at Trout Beck and overbridges near Redlands Bank and Long Marton.
Materials and Waste (PEI Report Chapter 11)	Likely to generate excess material that will require removal.	Likely to generate excess material that will require removal.	Likely to have a requirement for fill material.
Noise and Vibration (PEI Report Chapter 12)	Likely to be changes in noise effects arising from both construction and	Likely to be changes in noise effects noise impacts arising from both construction and operation.	Likely to be changes in noise effects noise impacts arising from both construction and

Topic	Red Alternative	Blue Alternative (Evolved version of the Preferred Route announced in Spring 2020)	Orange Alternative
	operation. There will be marginally fewer receptors affected by the Red Alternative compared to the Blue Alternative.		operation. There will be fewer receptors affected by the Orange Alternative compared to the Blue Alternative.
Population and Human Health (PEI Report Chapter 13)	All traffic would be directed around and to the north of Kirkby Thore, including HGVs related to the British Gypsum Plant, reducing the impacts of them driving on the narrow streets of Kirkby Thore. One residential property, Whinthorn House would require demolition to accommodate the route. Severance of PRoW and other WCH provisions due to the land required for the construction of the project. Land take required within an area allocated for town housing.	All traffic would be directed around and to the north of Kirkby Thore, including HGVs related to the British Gypsum Plant, reducing the impact of them driving on the narrow streets of Kirkby Thore One residential property, Whinthorn House would require demolition to accommodate the route. Severance of PRoW and other WCH provisions due to the land required for the construction of the project. Loss of or damage to key characteristics, features or elements of the agricultural holdings and potential effect of this change on viability. Land take required within Common Moss.	Existing alignment for the majority of traffic would be maintained past Kirkby Thore, though position of the new junctions allows HGVs related to the British Gypsum plant to be diverted north of Kirkby Thore to reduce the impact of them driving on the narrow streets of Kirkby Thore. Requirement for the demolition of a number of buildings at Bridge End Farm. Temporary land take of land adjacent to primary school allocation. Severance of PRoW and other WCH provisions due to the land required for the construction of the project. Portion of Acorn Bank (National Trust) and Piper Lane Recreational ground land to be required for this scheme during construction
Road Drainage and Water Environment (PEI Report	Crossing of Trout Beck on a multispan viaduct in order to minimise the level of impact related to the	Crossing of Trout Beck on a multispan viaduct would reduce the level of impact related to the constraining of the watercourse	Building crossing over Trout Beck at an already constrained point would reduce the impacts on the

Topic	Red Alternative	Blue Alternative (Evolved version of the Preferred Route announced in Spring 2020)	Orange Alternative
Chapter 14)	constraining of the watercourse, however there would still be impacts on the watercourse as a result of construction, and shading.	(compared to the PRA route, which had a longer crossing), however there would still be increased impacts on the watercourse as a result of construction, and shading.	watercourse compared to the Blue and Red Alternatives.

Appleby to Brough

3.5.10 Throughout Stages 1 and 2, a core principle adopted for the Appleby to Brough scheme was the aim to develop a route that could be constructed outwith the North Pennines AONB, in accordance with the *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)[5] paragraphs 5.151 and 5.152. Following a detailed design review from both an environmental and engineering perspective, however, it was determined that the preferred route for Appleby to Brough scheme could not be constructed without a small amount of land take within the North Pennines AONB designated area at the eastern tie-in (associated with a private access and local access road) and hence it was determined that further work was required to identify whether there was a suitable alternative to this alignment completely outwith the AONB. This process is detailed further in the *A66 Northern Trans-Pennine Route Development Report* (Highways England, 2021)[1].

3.5.11 An alternative was identified for the eastern tie-in, which maintained the route completely outwith the North Pennines AONB, though it does require the construction of a new route and embankment across an open area of landscape within the valley at this location. This has been referred to as the Orange alternative section.

3.5.12 Further environmental assessment of the alternative route outwith the AONB also identified potential for material landscape and visual impacts arising from the raised embankment across the valley to the north of Warcop. Discussions with key stakeholders also raised the challenge that the design should aim to have the minimal overall impact on the environment and the local community, whilst remaining compliant with national policy.

3.5.13 As a result of these design and assessment developments, and the feedback from stakeholder engagement regarding concerns about the design north of Warcop, alternatives to the central section of the route were developed for consideration. Through this process, it was determined that any alternative in this location would involve encroachment into the AONB, therefore, given the strong policy constraints set out in the *NPSNN* regarding development within an AONB, the core principles that were applied to the development of the alternatives (both at Warcop and the eastern tie-in) were:

[5] 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 [accessed 13 September 2021]

- Adhering to the policy constraints by avoiding compromising the purpose of the AONB designation.
- Retaining the new route as close to the existing route alignment as possible, and reusing the existing A66 where feasible, in order to minimise the footprint of the project and retain a single road 'corridor' alongside the AONB.
- Minimise any encroachment into the AONB as much as possible, and only for local or access infrastructure which can be designed to be in keeping with a rural setting.
- Minimising the number and impact of any watercourse crossings (as the watercourses in the area are tributaries of the River Eden SAC and SSSI, and flood risk is known to be a concern at Warcop).
- Maintain all local access routes, including access to the existing MoD facility to the north of existing A66 and minimise impacts on local residents, businesses, and farm operations.

3.5.14 As there were only identified issues in specific locations of the route, the route was divided into three sections (west, central and east). The west section remained the same as was described in the PRA and alternatives developed for each of the two sections identified as requiring change: three alternatives for the central section (Black, Green and Blue), and two for the eastern section (Black and Orange) as shown in Figure 3.2: PCF 3 Route Options for Appleby to Brough. Following a review process involving consideration of engineering, environmental, and stakeholder aspects, one alternative within the central section (Green) was discounted as it required greater land take from the AONB with the same visual impact as the Black Route (as it was retained on a significant embankment), as well as increased impact on the MoD training camp. Two potential alternatives in the central section (Black and Blue), and two potential alternatives in the eastern section (Black and Orange) remain. Combined with the unchanged western section, there are four different alternatives through Appleby to Brough that could be made of the combinations of alternative sections as described in Chapter 2: The Project and as shown in Figure 2.4: Appleby to Brough.

Environmental review of alternatives

3.5.15 Table 3-7: Key Environmental differences between alternatives considered at Appleby to Brough, outlines the key environmental differences between these remaining alternatives. Only material differences between the routes have been included in this table, however all three alternatives are assessed within each topic chapter in this PEI Report. Due to the nature of some topics, impacts have been assessed on a route wide approach, the results of which have been reported in the relevant chapter. Additionally, the information in this table is a brief summary of the major constraints and likely impacts, there may be additional constraints or opportunities described in further detail in the relevant topic chapter.

3.5.16 In the case of Appleby to Brough, it should be noted that as the alternatives are a combination of these sections, the potential impacts summarised in Table 3-7 could occur simultaneously. There may also be additional cumulative impacts as a result of certain combinations of alternatives. Chapter 4: Environmental Assessment Methodology sets out how the assessment has considered the potential impacts arising from the alternatives or the various combinations of alternatives that can be brought together to form route alignments for this scheme.

As set out in Chapter 2: The Project, we have considered the alternatives outlined and our preferred route for this scheme is the Black-Blue-Black route. The full reasons for this selection are outlined in more detail in the A66 Northern Trans-

Pennine Route Development Report (Highways England, 2021)[1] which sets out and summarises the environmental, policy and other factors leading to route selection.

Table 3-7: Key environmental differences between alternatives considered at Appleby to Brough

Topic	Black-Black-Black (Evolved version of the Preferred Route announced in Spring 2020)	Blue Alternative (central section)	Orange Alternative (eastern section)
Air Quality (PEI Report Chapter 5)	Slightly closer to the village of Warcop compared to Blue in the central section of the route.	The route is situated further from the village of Warcop compared to the Black-Black-Black route in the central section.	Works required closer to Brough in order to tie-in to existing A66.
Biodiversity (PEI Report Chapter 6)	Adverse effects on River Eden SAC and SSSI designations relating to habitat loss and potential for pollution of watercourses functionally linked to the site, and on Sandford Mire CWS relating to hydrology. There is the potential for effects to North Pennine Moors SAC and SPA, Argill Woods and Pastures SSSI and Augll Valley Pasture SSSI relating to air quality. Potential for adverse effects due to loss of Priority Habitats. Effects on bat roosts and bat activity, barn owls, amphibians, reptiles, terrestrial invertebrates and macrophytes, red squirrel and other terrestrial mammal species due to habitat loss and possible fragmentation impacts	Inclusion of the Blue Alternative Central Section would not give rise to any material differences in impact compared to the Black-Black-Black.	Inclusion of the Orange Alternative Section would give rise to similar effects as the Black-Black-Black, though the overall loss of habitats is expected to be greater and additional adverse effects related to the additional crossing of Lowgill Beck.
Climate (PEI Report	In the central section of the route, the Black	Considered to be at higher risk of flooding	No material differentiators

Topic	Black-Black-Black (Evolved version of the Preferred Route announced in Spring 2020)	Blue Alternative (central section)	Orange Alternative (eastern section)
Chapter 7)	alterative requires the construction of embankment in a floodplain which may be subject to erosion due to increased wet weather and floodwater.	than the Black Central alternative as the Blue alternative runs predominantly at grade through a floodplain.	between the Orange alternative and the Black Eastern alternative.
Cultural Heritage (PEI Report Chapter 8)	Physical impact to the Sandford Moor Barrows and Sandford Ring Cairn Site in the Black Central alternative.	Avoids physical impact to Sandford Moor Barrows and Sandford Ring Cairn Site that would arise from the Black Central alternative.	Avoids physical impact to Sandford Moor Barrows and Sandford Ring Cairn Site that would arise from the Black Central alternative.
Geology & Soils (PEI Report Chapter 9)	No material differentiating constraints		
Landscape and Visual Effects (PEI Report Chapter 10)	Requires minor land take within the AONB for construction. The eastern section encroaches into the designation in order to allow online widening of the A66, though infrastructure constructed within the AONB is limited to local access and private access. The central section requires the construction of an embankment which reaches 8m at its highest point, changing the local landscape character and potentially affecting on the setting of the AONB.	Requires construction within the AONB, and the local access road will remain within the boundary for operation. However, road is retained within its current corridor and the embankment required is significantly lower than the Black alternative within the central, therefore overall lower landscape and visual effects. Construction of new MoD facility will require construction within the AONB though provides opportunity for rationalisation and landscape screening of existing features that impact on the AONB.	Avoids the requirement for a land take within the AONB designated area, however requires construction offline from the existing alignment with a substantial feature cutting across an open valley. Potential for greater landscape and visual effects overall as a result of changes to landscape and visual amenity and potential impacts on the setting of the AONB.
Materials & Waste (PEI	No material differences.		

Topic	Black-Black-Black (Evolved version of the Preferred Route announced in Spring 2020)	Blue Alternative (central section)	Orange Alternative (eastern section)
Report Chapter 11)			
Noise & Vibration (PEI Report Chapter 12)	Likely to be changes in noise effects noise impacts arising from both construction and operation.	Likely to be changes in noise effects arising from both construction and operation. Inclusion of the Blue Alternative Central Section in place of the Black Central Section will result in fewer receptors experiencing changes in noise level compared to the Black-Black-Black.	Likely to be changes in noise effects noise impacts arising from both construction and operation. Inclusion of the Orange Eastern Section in place of the Black Eastern Section will result in more receptors experiencing changes in noise level compared to the Black-Black-Black.
Population and Human Health (PEI Report Chapter 13)	Walkers, cyclists and horse riders affected by severance of PRoW and other WCH provisions due to the land required for the construction of the project. Agricultural land holdings potential affected due to the loss of or damage to key characteristics, features or elements of the agricultural holdings and potential effect of this change on viability. Potential effect on the Ministry of Defence as a result of potential loss of use/access of land during construction.	No material differences likely to arise with the inclusion of the Blue Alternative Central Section in place of the Black Central Section.	Inclusion of the Orange Alternative Eastern Section in place of the Black Eastern Section may impact on the rowan House housing allocation
Road Drainage and	Differing junction arrangement requires	Differing junction arrangement requires	Requires an additional

Topic	Black-Black-Black (Evolved version of the Preferred Route announced in Spring 2020)	Blue Alternative (central section)	Orange Alternative (eastern section)
Water Environment (PEI Report Chapter 14)	some different watercourse crossings.	some different watercourse crossings.	watercourse crossing of Lowgill Beck offline of the A66's existing alignment.

Cross Lanes to Rokeby

3.5.17 Following review and consultation with statutory bodies and local groups regarding potential impacts upon traffic flows, safety and heritage assets, a number of alternative junction alignments 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 and alternatives were developed for each (though it is noted that in relation to traffic flows, the two are closely linked, and all relevant assessments have considered this interaction). The alternatives are shown on Figure 3.3: PCF 3 Route Options for Cross Lanes to Rokeby and, including the original alignment, comprised two alternatives at Cross Lanes (Black and Blue) and four alternatives at Rokeby (Black, Red, Green, Orange). Following the review process two alternatives (Orange and Green) within the Rokeby section were discounted. Both of these alternatives considered moved the mainline closer to the existing A66. These two alternatives would have required the demolition of The Old Rectory, a heritage asset connected with the setting of the Registered Park and Gardens and would retain traffic close to (and within the setting of) St Mary's Church, and were therefore discounted.

3.5.18 Two alternative junction arrangements at Cross Lanes (Black and Blue) and two alternative junction arrangements at Rokeby (Black and Red) remain. Following the Preferred Route Announcement, the black route has evolved following feedback from stakeholders and technical specialists. At Cross Lanes the preferred route announcement design evolved from an overbridge and road connecting the B6277 and Moor House Lane with slip roads to a compact grade separated junction in order to reduce land take. At Rokeby junction, the design has been changed from an overbridge to an underpass to reduce landscape and visual impacts and setting impacts upon local heritage sites.

Environmental Review of Alternatives

3.5.19 Table 3-9: Key environmental differences between alternatives considered at Cross Lanes and Table 3-10: Key environmental differences between alternatives considered at Rokeby outline the key environmental differences between these remaining alternatives. Only material differences between the routes have been included in this table, however all three alternatives are assessed within each topic chapter in this PEI Report. Due to the nature of some topics, impacts have been assessed on a route wide approach, the results of which have been reported in the relevant chapter. Additionally, the information in this table is a brief summary of the major constraints and likely impacts, there may be additional constraints or opportunities described in further detail in the relevant topic chapter.

3.5.20 As set out in Chapter 2: The Project, we have considered the options outlined and our preferred route for this scheme is the Blue + Black route. The full reasons for

this selection are outlined in more detail in the *A66 Northern Trans-Pennine Route Development Report (Highways England, 2021)*[1] which sets out and summarises the environmental, policy and other factors leading to route selection.

Cross Lanes

Table 3-8: Key environmental differences between alternatives considered at Cross Lanes

Topic	Black (Evolved version of the Preferred Route announced in 2020)	Blue (Cross Lanes) Alternative
Air Quality (PEI Report Chapter 5)	No material differentiating constraints	
Biodiversity (PEI Report Chapter 6)	Impacts upon habitats and species will be similar for both the black route and blue alternative though black has smaller land take.	Impacts upon habitats and species will be similar for both the black route and blue alternative however a larger area of land take is required for the blue alternative which includes additional watercourses. A reduction in land take paired with appropriate mitigation would reduce potential impacts.
Climate (PEI Report Chapter 7)	No material differentiating constraints	
Cultural Heritage (PEI Report Chapter 8)	Impacts upon heritage assets would be similar for both the black route and blue alternative, though black has smaller area of disturbance.	Impacts upon heritage assets would be similar for both the black route and blue alternative, however this alternative would require a greater footprint beyond the area of the existing road corridor leading to potential impacts upon archaeological remains.
Geology and soils (PEI Report Chapter 9)	Effects upon agricultural land.	Larger road footprint, potential for an increase in loss of agricultural land.
Landscape and Visual Effects (PEI Report Chapter 10)	Impacts upon landscape character and views are likely to be similar for both options.	Impacts upon landscape character and views are likely to be similar for both options however a larger area of land is required for the blue alternative which may alter slightly more of the existing landscape pattern. A reduction in land take paired with appropriate mitigation would reduce potential impacts.
Material Assets & Waste (PEI Report Chapter 11)	No material differentiating constraints	

Topic	Black (Evolved version of the Preferred Route announced in 2020)	Blue (Cross Lanes) Alternative
Noise and Vibration (PEI Report Chapter 12)	Due to the nature of noise effects, noise was modelled across the four potential route combinations (rather than specific comparison of each junction). When you compare route combinations involving black and blue Cross Lanes junctions (i.e. Black-Black vs Blue-Black or Black-Red vs Blue-Red) there are a similar number of receptors affected by noise positively and adversely. The Cross Lanes alternatives are therefore not considered to be materially different in noise terms.	
Population and Health (PEI Report Chapter 13)	Smaller area of agricultural land take proposed for black option. All other effects would be similar for both the black route and blue alternative.	Larger area of agricultural land take for alternative. All other effects would be similar for both the black route and blue alternative. Opportunity for an improved north-south connection for walkers, cyclists and horse-riders.
Road drainage and water environment (PEI Report Chapter 14)	Effects upon watercourse crossings would be similar for both the black route and blue alternative.	Effects upon watercourse crossings would be similar for both the black route and blue alternative however a greater number of watercourse crossings would be required for the Blue alternative. A reduction in watercourse crossings paired with appropriate mitigation would reduce potential impacts.

Rokeby

Table 3-9: Key environmental differences between alternatives considered at Rokeby

Topic	Black (Evolved version of the Preferred Route announced Spring 2020)	Red (Rokeby) Alternative
Air Quality (PEI Report Chapter 5)	No material differentiating constraints	
Biodiversity (PEI Report Chapter 6)	Impacts upon habitats and species will be similar for both the black route and Red alternative. Some notable trees may be impacted. Impacts upon hedgerow. Mitigation would be explored to mitigate and minimise potential impacts.	Impacts upon habitats and species will be similar for both the black route and Red alternative. Direct impact upon Church Plantation by the junction (which may include notable trees and important habitats). Design of the underpass could be of benefit if suitable for use for safe passage of species under the A66. There are also opportunities of creating habitat linkages/connectivity between Church Plantation to the north and

Topic	Black (Evolved version of the Preferred Route announced Spring 2020)	Red (Rokeby) Alternative
		Jack Wood to the south (e.g. via additional hedgerow/woodland planting).
Climate (PEI Report Chapter 7)	No material differentiating constraints	
Cultural Heritage (PEI Report Chapter 8)	Detrunking the current A66 between Rokeby Park and St Mary's Church, may lead to a reduction in traffic along this section of the road, although traffic would still be required to use the detrunked section to access the Barnard Castle Road. This would restore the historic links between the Old Rectory and St Mary's Church. However there would be setting changes to Rokeby Park and Gardens (a Grade II* registered park and garden), St Mary's Church, the Old Rectory and the Grove associated with new junction and alignment to the south.	This option would result in fragmentation of and introduction of traffic to a nationally designated heritage asset (Rokeby Park and Gardens), potentially leading to harm of that asset. Temporary severing of the historic 'Church Walk' from the main estate to the church. Non-compliance with NNNPS due to direct impacts upon the Registered Park and Gardens (5.130, 5.131, 5.132). With appropriate mitigation it is considered that setting impacts related to this option could be reduced however the direct loss and fragmentation of the RPG cannot be mitigated.
Geology and soils (PEI Report Chapter 9)	No material differentiating constraints	
Landscape and Visual Effects (PEI Report Chapter 10)	Partial removal of notable trees to the north of the proposed junction and fringe trees associated with Church Plantation, the would also be an alteration of field pattern in this area.	Permanent loss of woodland (likely including notable trees) at Rokeby RPG, junction impinges upon the setting of the RPG and contribution to landscape character. Opportunities for mitigation such as the planting and grading of the underpass would integrate the underpass with the landform, ecologically connecting with the Church Plantation and restoring a woodland element of the Rokeby Park RPG.
Materials & Waste (PEI Report Chapter 11)	No material differentiating constraints	

Topic	Black (Evolved version of the Preferred Route announced Spring 2020)	Red (Rokeby) Alternative
Noise (PEI Report Chapter 12)	This topic assessed this scheme as the four potential route options only. Initial modelling and the preliminary assessment shows similar numbers of receptors having improved or negative impacts for all options. When you compare route combinations involving black and red Rokeby junctions (i.e. Black-Black vs Black-Red or Blue-Black vs Blue-Red) substantially more receptors are affected from the red junction alternative than the black alternative. However, it should be noted that similar number of receptors are positively affected than adversely (and in the case of the Blue-Black more receptors benefit than are adversely affected). This is due to changes in traffic movements on the local road network changing the noise environment within the ARN (both positively and adversely).	
Population and Health (PEI Report Chapter 13)	No material differentiating constraints	
Road drainage and water environment (PEI Report Chapter 14)	Impacts upon road drainage and water environment are likely to be similar for both the black evolved preferred route and the red alternative. Black route is located slightly closer to a watercourse.	Impacts upon road drainage and water environment are likely to be similar for both the black evolved preferred route and the red alternative Red alternative is located at a larger distance from the watercourse.

3.5.1 At the time the design snap-shot was taken to inform this PEI Report, it was considered possible that the route eventually selected for this scheme could comprise any combination of the alternatives described in each section. There are therefore four possible route variations considered within the assessment presented in this report:

- Black + Black (evolved version of the PRA)
- Black + Red (evolved PRA for Cross Lanes with an alternative junction for Rokeby)
- Blue + Black (an alternative junction for Cross Lanes with the PRA for Rokeby)
- Blue + Red (an alternative junction for both Cross Lanes and Rokeby).

3.5.2 Chapter 2: The Project, provides a description of the project including the alternative alignment routes, sections and junctions that are still under consideration and for which public and stakeholder views are sought. These are as summarised in Table 3 10: Alternatives Under Consideration at PEI Report Stage, and are presented in Figure 2-1: M6 Junction 40 to Kemplay Bank to Figure 2-8: A1(M) Junction 53 Scotch Corner.

Table 3-10: Alternatives Under Consideration at PEI Report Stage

Scheme	Alternatives
M6 Junction 40 to Kemplay Bank	Preferred Route with design refinements
Penrith to Temple Sowerby	Preferred Route with design refinements
Temple Sowerby to Appleby	Blue Alternative (Evolved Preferred Route) Orange (Online Alternative)

Scheme	Alternatives
	Red (Offline Alternative)
Appleby to Brough	Black (Evolved Preferred Route) Blue Alternative - Central Section Orange Alternative - Eastern Section
Bowes Bypass	Preferred Route with design refinements
Cross Lanes to Rokeby	Black (Evolved Preferred Route) Cross Lanes – Blue Alternative Junction Rokeby – Red Alternative Junction
Stephen Bank to Carkin Moor	Preferred Route with design refinements
A1(M) Junction 53 Scotch Corner	Preferred Route with design refinements