

Smart Motorways Programme

M4 Junctions 3 to 12 Smart Motorway

Non-Material Change Junction 5 No Through junction Running Technical Note

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1 Introduction

The M4 Junctions 3 to 12 Smart Motorway Scheme (the scheme) was developed in accordance with Interim Advice Note (IAN) 161/13. This IAN stipulated a default position that all junctions within an All Lane Running (ALR) scheme would implement Through Junction Running (TJR), except at motorway-motorway interchanges and terminal junctions. However, as scheme development continued, IAN 161/15 was released, and the scheme was able to implement elements of the updated IAN into its design. One of these elements was that each scheme should consider the best operating regime for each junction and not apply a scheme wide regime.

The traffic model was validated using observed traffic data and found to be suitable for continued use (as explained in Appendix D of the Application Statement). Predictions of traffic flows were provided to assess each junction for potential to operate with No Through Junction Running (No TJR). The review found that the most suitable operating regime at junction 5 is No TJR. This decision was accepted by the scheme's Safety Control Review Group (SCRG).

This Non-Material Change (NMC) technical note provides a summary of the analysis undertaken to inform the decision-making process on the most suitable operating regime at junction 8/9 of the scheme; and appraises the impact of those changes compared to the impacts reported at DCO stage for TJR.

2 Background

The M4 is a strategic part of both the English and Welsh road network, connecting London to South Wales. The scheme is located on 32 miles of the M4, between junction 3 and junction 12. It comprises of 28 miles of three-lane motorway and four miles of four-lane motorway between junction 4 and 4b. The scheme includes the M4 to M25 interchange; the junction for Heathrow Airport and passes by several key regional centres including Slough, Windsor, Maidenhead, Wokingham and Reading.

3 2015 DCO Design

The design upon which the DCO was granted implemented TJR and required widening of all four overbridges at the junction by 4.5m outward from the M4, leaving the central reserve unchanged. Each of the bridges are three span concrete box girders. The proposal was to widen the bridges using steel girders and a concrete deck slab.

Langley Interchange Subway was also planned to be widened by 3.2m at each end using a reinforced concrete frame.

4 Reasons for Proposed Change

Apart from motorway to motorway interchanges with free-flowing link roads, the default position for all junctions within an all lanes running scheme designed to IAN 161/13, was for the provision of TJR. Previous TJR appraisals were carried out in accordance with this principle. However, latest guidance in IAN 161/15 recommends schemes identify the “*most appropriate layout following analysis of the design year traffic flows and any operational or physical constraints*”.

The scheme was designed to IAN 161/13 and the operating regime was endorsed at Safety Control Review Group (‘SCRG’) in 2013. Therefore, the DCO to construct the scheme was granted on 2nd September 2016 on the basis that junction 5 would be widened to accommodate TJR.

As a result of updated guidance in IAN 161/15, a review into the most appropriate layout for junction 5 has been undertaken. The review has considered operational and physical constraints, extensive traffic modelling/forecasting and safety assessments, along with feedback from operational SM-ALR (All Lane Running) schemes.

The review found that the most suitable operating regime at junction 5 is No TJR or Dual 3 lane Motorway (D3M). This decision was accepted by the scheme’s SCRG and forms the basis of this NMC application.

This technical note summarises the analysis undertaken during this review.

5 Congestion Appraisal

The appraisal of congestion at J5 is based on data described in Section 6.1. Routine congestion occurs on the eastbound main carriageway through the junction and on the merge slip road in both the AM and PM peaks. The congestion originates downstream of the merge and is assumed to be caused by the downstream diverge to M25 at J4b interchange operating significantly over capacity. The diverge at J4b to M25 will be improved by the scheme, with the increased capacity likely to reduce the occurrence of congestion. Therefore current congestion is not considered to be a significant factor in the layout of J5 eastbound.

Routine congestion occurs on the westbound main carriageway through the junction in the AM peak. However this originates downstream of the junction at J6, as described in Appendix F of the Application Statement. This congestion is not considered to be significant to the suitability of TJR and No TJR layouts.

6 Operational Appraisal of Junction 5

The aim of the appraisal was to determine the suitability of either a TJR or No TJR layout for the junction at the scheme design year (2037). The peak hour forecast traffic flows for 2037 have been used to determine the most appropriate operational solution for junction 5 (in terms of optimising the junction layout and demonstrating it is the most effective layout).

As described in Appendix D of the Application Statement, a model verification exercise of the existing model setup has been undertaken against 2018 WebTRIS traffic data (including accounting for Tempo Growth) to evaluate the continuing use of the model and performance of its forecasting accuracy to inform the operational and environmental assessments.

The findings of the model verification showed that across all explicitly modelled peak time periods the model provides a good match with the observed WebTRIS data (as detailed in Appendix D of the Application Statement) and is therefore robust and suitable for continued use to assess the likely impacts of the Proposed changes to the Scheme for operational and environmental assessments.

In this section, traffic data has been plotted on charts to visualise forecast traffic growth and flows relative to the capacity of each link. For intra junction flows, TD22/06 “Layout of Grade Separated Junctions” specifies the maximum flow per lane for motorways as 1800 vehicles per hour (vph) per lane and therefore 5400vph for three lanes. The introduction of variable mandatory speed limits (VMSL) may allow up to 2000vph per lane, however, in reality the maximum throughput on any link is subject to a number of factors such as link length; merges and diverges; gradients; proportion of heavy goods vehicles (HGVs); weather conditions; etc. Furthermore, as flows approach the maximum capacity of a link there will be a tendency for speeds to reduce until flow breakdown occurs. Therefore, the appraisal of flows in this section should be seen as subjective, and maximum capacities should not be considered as a pass/fail criteria, instead, higher flows should be considered as having a greater risk of causing regular congestion.

6.1 Operation appraisal eastbound

Figure 1 shows traffic data for the early AM peak from the validated traffic model (morning peak travel time period from 07:00 to 08:00) through junction 5 eastbound.

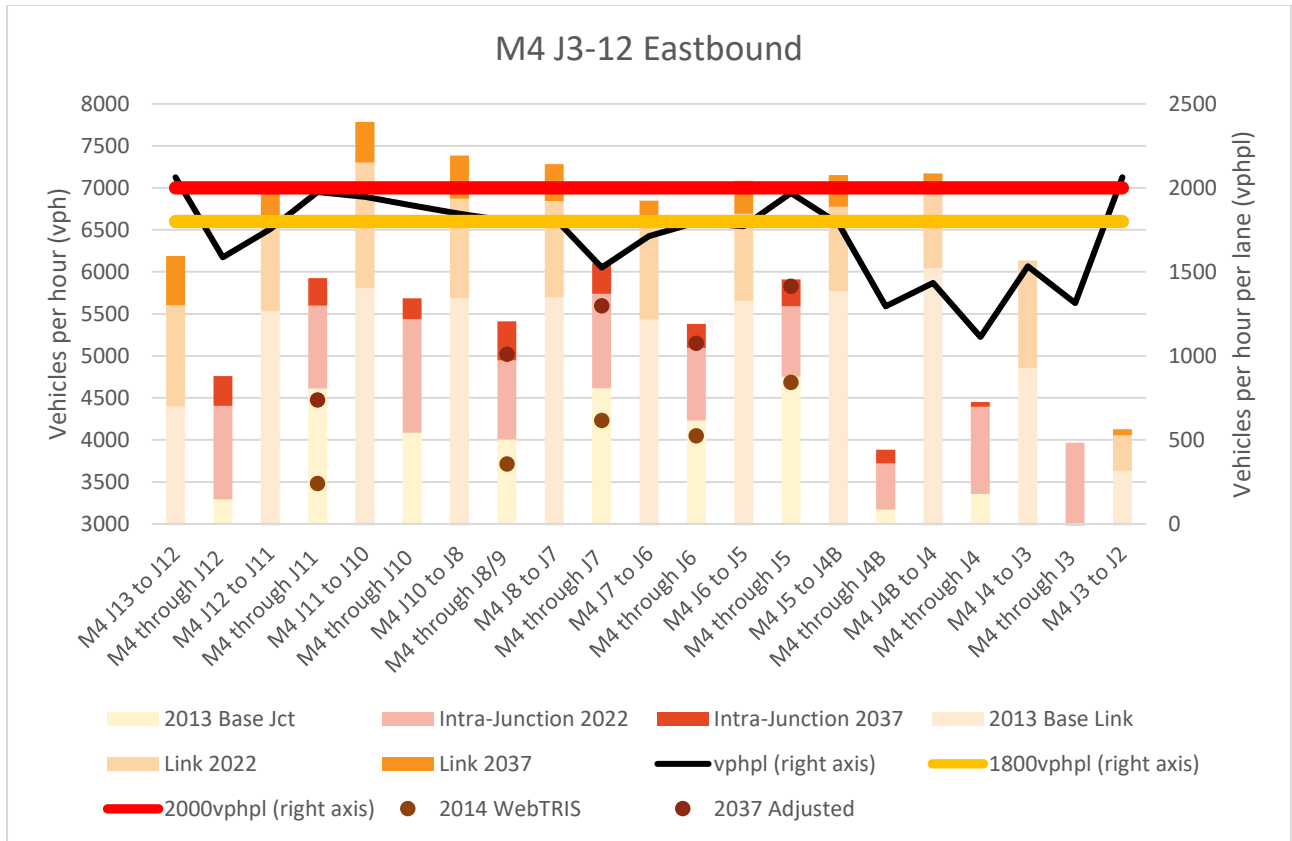


Figure 1 Junction 5 Eastbound AM peak flows

The traffic model data indicates intra junction flow without TJR (three lanes) will be 5590 vehicles per hour (vph) (i.e. less than 2000 vph per lane) compared to 5730vph with TJR in the opening year (2022) and 5910 vph (i.e. less than 2000 vph per lane) compared to 6125vph with TJR in the design year (2037). Flows on the upstream mainline link are also forecast to be approximately 1800vph per lane in 2037, indicating similar levels of risk of congestion as intra junction with No TJR or TJR.

Therefore, the adoption of No TJR at junction 5 is expected to have no significant impact on the overall scheme benefits in terms of traffic flow.

6.2 Appraisal westbound

Figure 2 shows traffic data for the PM peak (afternoon peak travel time period from 17:00 to 18:00) peak through junction 5 westbound from the model.

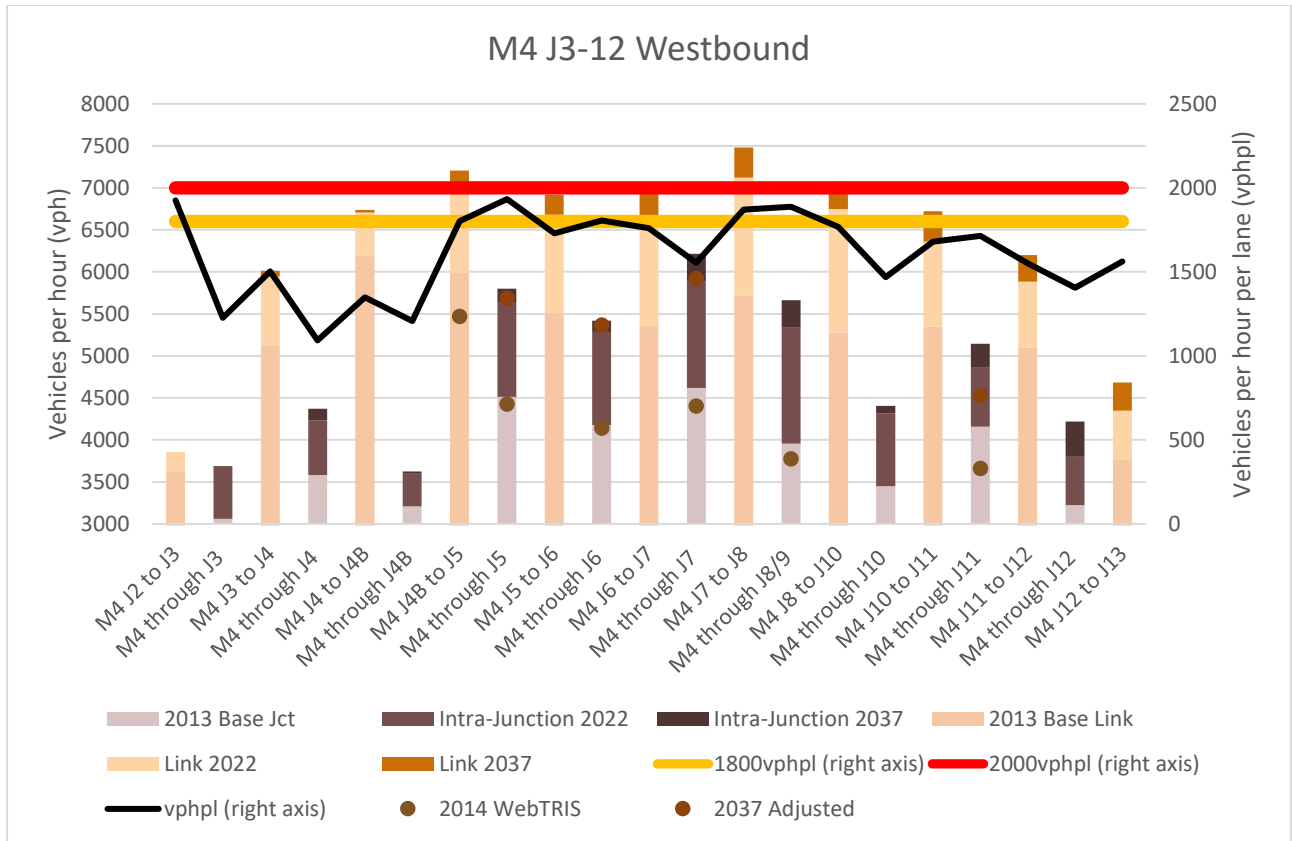


Figure 2 Junction 5 Westbound PM peak flows

The traffic model data indicates intra junction flow with No TJR (three lanes) will be 5630vph (i.e. less than 2000vph per lane) compared to 5765vph with TJR in the opening year, and 5800vph with No TJR (i.e. less than 2000 vph per lane) compared to 5970vph with TJR in the design year. Flow on the upstream mainline link is forecast to be 7205vph with No TJR, slightly less than 7320vph with TJR in 2037, indicating similar levels of risk of congestion as intra junction with No TJR.

Therefore, the adoption of No TJR at junction 5 is expected to have no significant impact on the overall scheme benefits in terms of traffic flow.

7 2021 NMC Design

The DCO to construct the scheme was granted on 2nd September 2016 on the basis that junction 5 would be widened to accommodate TJR. The decision to implement No TJR at junction 5, based on operational and safety evidence, requires alterations to the scheme design and therefore the scheme's DCO. This section of the technical note summarises the changes in design of the scheme.

7.1 Appraisal Data

The congestion and operational appraisals have been undertaken using the data sources shown in Table 1.

Data	Source	Data Range	Purpose
Traffic flow data	WebTRIS (MIDAS Loops)	November 2016	Informs analysis of existing traffic flows
	M4 J3-12 Traffic Model validated in 2019	2013, 2022 and 2037	Informs analysis of forecast traffic flows
Motorgraph Plots (MTV)	TRL (Transport Research Laboratory)	November 2016	Informs analysis of traffic speeds and congestion seed points

Table 1 Traffic appraisal data sources used in congestion and operational appraisals

7.2 Junction layout

The junction is proposed to run as No TJR. Three lanes and a hard shoulder in each direction will remain through the intra-junction with the exception of the area between the junction underbridges where the cross-section is not wide enough to support a hard shoulder.

Both the westbound and eastbound diverges will be a Type C layout as per DMRB TD22/06 – a lane drop at taper diverge. Both the westbound and eastbound merges will be Type E lane gains. All proposed layouts at junction 5 fit within the existing pavement width. Currently the eastbound merge is Type D, and westbound merge is Type A (Option 1). The eastbound diverge is currently Type A (Option 1) and westbound diverge is Type C

New VRS is proposed on the slip roads and in some areas of the intra-junction to protect new hazards such as gantries and signs.

The No TJR design does not require widening of the existing two underbridge structures and subway located at junction 5 and these are removed from the DCO.

7.3 Gantry changes

Gantry locations are primarily set by the datum point of the merge/diverge lanes at the junction, which have moved as a result of no longer implementing TJR. As a result, the gantry arrangement associated with junction 5 has required amendment.

This includes accounting for the fact that gantry positions were subject to limits of deviation outlined in the DCO as granted in September 2016 and some of the new locations are outside of these limits as shown on the Works Plans associated with the made DCO, noting that there is no limit of deviation for existing gantries which cannot be reused and need to be relocated.

Figure 3 shows a schematic of the previously proposed TJR layout of junction 5, with four lanes through the junction on both carriageways.

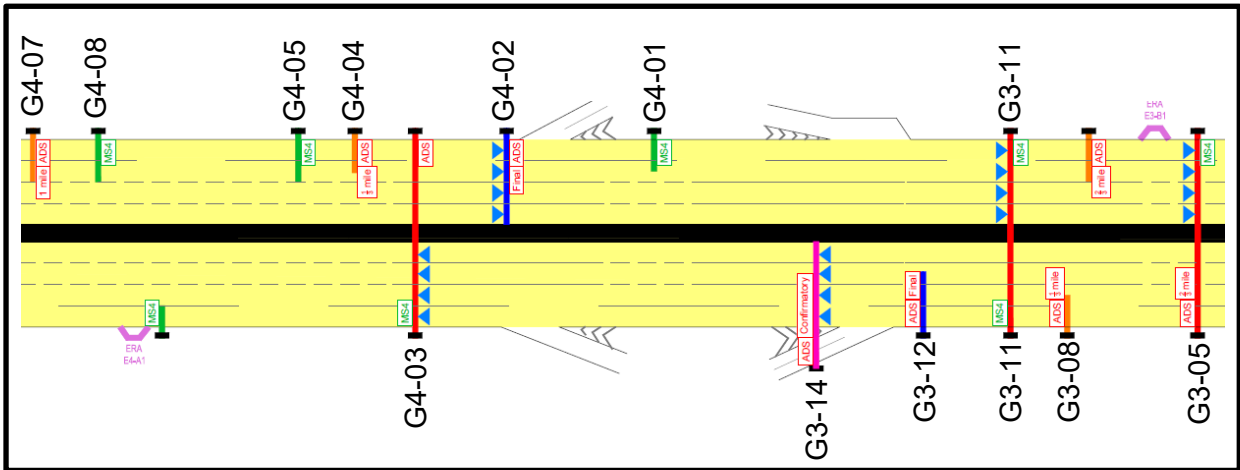


Figure 3 Schematic showing layout of junction 5 with TJR in 2015

Figure 4 shows the current proposed layout of junction 5 (with No TJR). The No TJR proposed layout at Langley Interchange is a lane-gain/lane-drop arrangement maintaining the three existing lanes and hard shoulder (discontinued across and between the underbridges) in each direction through the Interchange. The alignment and associated lining have been designed to fit within the existing footprint the overbridge at junction 5.

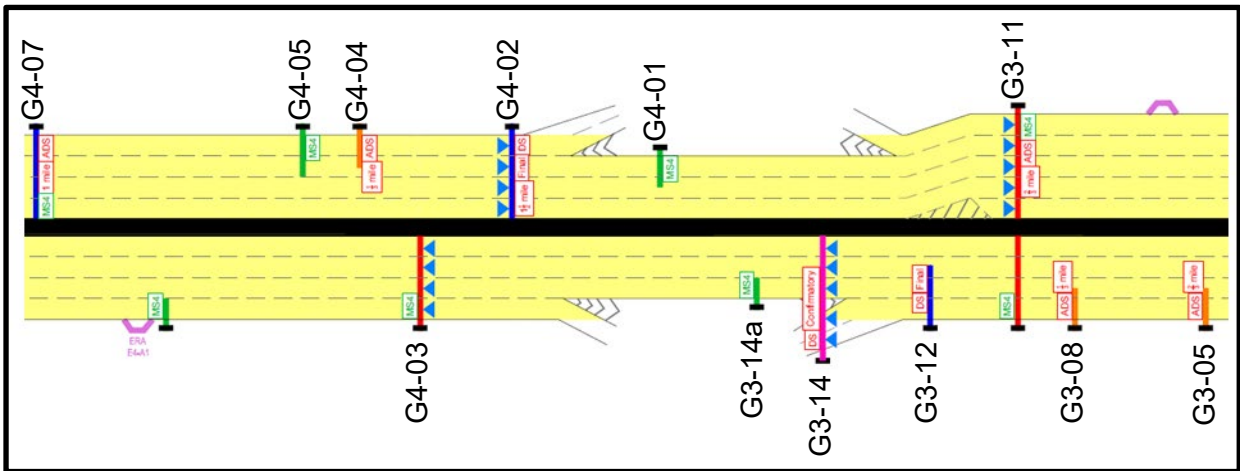


Figure 4 Schematic showing layout with junction 5 without TJR

The details eastbound and westbound gantries are provided in Table 2 and Table 3 respectively. The changes to gantry location between TJR and No TJR are shown.

Gantry reference	New/existing	2015 location and type (TJR)	Current proposed location and type (No TJR)	Change to gantry	Outside Limit of Deviation	Reason for change
G4-07	Proposed	22505 ADS Cantilever	22507 Super Cantilever	Type change	No	Changed to super cantilever to house MS4 from removed G4-08
G4-08	Proposed	22275 MS4	Removed	Removed	No	Gantry removed due to visibility issues associated with existing geometry, with MS4 moved onto G4-07
G3-11	Proposed	19058 Super-span Portal	19058 Super-span Portal	No change	No	ADS signs added from removed G3-092

Table 2 Location and changes to eastbound junction 5 gantries

Gantry reference	New/existing	2015 location and type (TJR)	Current proposed location and type (No TJR)	Change to gantry	Outside Limit of Deviation	Reason for change
G3-05	Proposed	18396 Super-span Portal	18396 ADS Cantilever	Type change	No	Change from super-span to ADS cantilever to remove requirement of foundation on eastbound carriageway.
G3-14a	Proposed	N/A	19975	New since 2017	No	New MS4 proposed since DCO granted
G4-03	Proposed	21155 Super-span Portal	21155 Super Cantilever	Type change	No	Utilities found in verge

Table 3 - Location and changes to westbound junction 5 gantries

7.4 CCTV and POP Changes

As a result of the changes to the junction design and gantry provision, changes are also required to the CCTV and Police Observation Posts located in and around Junction 5. Their changed position is shown on the plans accompanying the NMC application.

7.5 Drainage changes

The changes from the 2015 DCO drainage proposals as a result of implementing No TJR at the junction are described below:

East of Junction

Drainage proposals in the eastbound merge and westbound diverge has changed from the 2015 DCO proposed slotted linear drainage channel to retention of the existing drainage.

Further east of the slip roads, the eastbound and westbound verges maintain the 2015 DCO proposals of retention of existing drainage and new slotted linear drainage channel. There are some sections of new filter drains in the eastbound verge where it was not feasible to retain the existing filter drain as indicated previously in the 2015 DCO.

Intra-Junction

In the eastbound and westbound verges, the slotted linear drainage channel proposed in the 2015 DCO has been replaced with retained existing gullies.

West of Junction

Drainage proposals in the eastbound diverge has changed from the 2015 DCO proposed slotted linear drainage channel along the full length to retention of existing drainage, except for a 200m section where the new slotted linear drainage is maintained. Drainage proposals in the westbound merge has also changed from the 2015 DCO proposed slotted linear drainage channel along the full length to retention of existing drainage, with a 200m section replaced with new combined kerb and drainage units.

Further west of the slip roads, the eastbound verge consists of greater lengths of existing drainage being retained instead of the being replaced entirely with slotted linear drainage channels. There is approximately 700m of new slotted linear drainage channels proposed in the latest proposals in the eastbound verge. The westbound verge maintains the 2015 DCO proposals of retention of existing drainage close to the westbound merge and most of the existing drainage that was proposed to be abandoned has been retained with a 150m section of new slotted linear drainage channel proposed to the east of Riding Court Overbridge.

Central Reserve

In the central reserve, the drainage proposals remain as previously shown in the 2015 DCO of slotted linear drainage channel with the exception of the intra-junction where the existing filter drain is retained.

Summary

In summary, there have been numerous changes to the 2015 DCO drainage proposals, mostly involving the retention of existing drainage with some sections of new drainage where it was not possible to retain the existing drainage.

7.6 Earthworks changes

7.6.1 2015 DCO Design

The 2015 DCO Design for junction 5 indicated earthwork widening was only required through the mainline intra-junction area, in order to achieve TJR, as summarised below.

East of Junction

- Eastbound – no widening.
- Westbound – no widening.

Intra-Junction

- Eastbound Ch 20000-20310 (approx.) – Conventional steepened earthworks at 1v:1.5h and (locally) steeply sloping reinforced earth solutions.
- Westbound Ch19990-20290 (approx.) – Conventional steepened earthworks at 1v:1.5h and (locally) steeply sloping reinforced earth solutions.

West of Junction

- Eastbound – no widening.
- Westbound – no widening.

7.6.2 2018 DCO Discharged Design

The 2018 DCO Discharged Design, included new earthworks widening, on both sides of the M4, to the east and west of the junction on the basis that improved topographic data indicated that the existing carriageway verges on the approaches to the junction were not as wide as had previously been assumed based on the available topographic datasets used in the 2015 DCO Design.. Outline details of the 2018 DCO Discharged Design are summarised below.

East of Junction

- Eastbound Ch19100-19800 (approx.) – generally minor conventional earthworks embankments and (locally) cuttings. Sub-vertical concrete slab-on-end at east-end.
- Westbound Ch19100-19800 (approx.) – generally minor conventional earthworks embankments, (locally) cuttings and sub-vertical concrete slab-on-end; vertical steel sheet piled wall at signage gantry G3-12 build-out (Ch19370-19400 approx).

Intra-Junction

- Eastbound – vertical steel sheet piled wall at signage gantry G4-01 build-out (Ch20300-20330 approx.).
- Westbound – no widening.

West of Junction

- Eastbound Ch20500-21200 - generally minor conventional earthworks embankments, L-shaped reinforced concrete wall across north portal of Ditton Road Subway.
- Westbound Ch20500-21200 - generally minor conventional earthworks embankments, L-shaped reinforced concrete wall across south portal of Ditton Road Subway and another 50m (approx.) to west.

7.6.3 2021 NMC Design

The 2021 NMC Design is broadly similar to the 2018 DCO Discharged Design, with generally minor earthworks interventions along the mainline approaches to junction 5 and with sections of sub-vertical concrete slab-on-end having been replaced with earthworks. Optimisations have

allowed the removal of the previous L-shaped reinforced concrete walls local to the south portal of Ditton Road Subway. Following the adoption of the 'do minimum' approach at junction 5 the intra-junction area is also broadly similar to the 2018 DCO Discharged Design. Outline details of the 2021 NMC Design are summarised below.

East of Junction

- Eastbound Ch18500-19800 (approx.) – generally minor conventional earthworks embankments and (locally) cuttings. Sub-vertical concrete slab-on-end at east-end, and additional vertical steel sheet piled wall at Emergency Area E3-B1 (Ch18550) to ensure associated earthworks are retained within permanent landtake.
- Westbound Ch19100-19800 (approx.) – generally minor conventional earthworks embankments, (locally) cuttings and sub-vertical concrete slab-on-end; vertical steel sheet piled wall at signage gantry G3-12 build-out (Ch19370-19400 approx.) replaced with concrete slab-on-end.

Intra-Junction

- Eastbound – generally minor discontinuous earthworks, but with sub-vertical concrete slab on end local to Ch19800; vertical steel sheet piled wall at verge build-outs at gantry G4-01 (Ch20310) and at Ch20490.
- Westbound – generally minor discontinuous earthworks, but with sub-vertical concrete slab on end and vertical steel sheet piled walls, located between mainline and westbound merge slip, between Ch20300 and Ch20500.

West of Junction

- Eastbound Ch20500-21200 - generally minor conventional earthworks embankments, L-shaped reinforced concrete wall across north portal of Ditton Road Subway replaced with concrete slab-on-end.
- Westbound Ch20500-21200 - generally minor conventional earthworks embankments, L-shaped reinforced concrete wall across south portal of Ditton Road Subway and another 50m (approx.) to west replaced with concrete slab-on-end and earthwork (respectively).

7.6.4 Change Summary

In summary, the key changes between the 2015 DCO Design and the current 2021 NMC Design are the significant reduction of the areas of junction approach verge earthworks requiring widening, and the additional requirement for more vertical retaining walls in order to keep the earthworks footprint within the available landtake. These changes reflect matured design (e.g. the fixing of verge build-out locations), and the provision of new and improved topographic data, which indicated narrower verges on the approaches to and through the junction than had previously been anticipated.

8 Safety

8.1 Driver and Non-Motorised User safety

The findings of the operational appraisal above have found that forecasted flows on the mainline are acceptable with No TJR and therefore would provide an equally safe environment for drivers as TJR. Furthermore, the provision of a hard shoulder intra-junction would also provide a place of relative safety for road users.

The proposed change has a positive impact to pedestrian safety because there will now not be any works carried out to the subway. There is no other pedestrian access either in the 2015 DCO design or in this proposal to other areas of the junction.

A safety risk assessment comparing TJR and No TJR confirmed that No TJR has the potential to reduce exposure of road users to risks on the approach to junction 5.

Gantry changes have been assessed to ensure that all signs and signals located on these gantries can be seen clearly by drivers within the relevant design standards (IAN 161/13).

8.2 Workforce safety

Widening of structures to accommodate TJR at junction 5 would require extensive works. Retaining the existing No TJR layout at junction 5 will significantly shorten the programme of works required, as well as greatly reducing the complexity of the programme, and therefore reduce the exposure of risk to workers.

Changes to gantries are considered neutral, given the small amount of change. Existing procedures are in place for installation of all gantry types and this change does not present any new risk or procedures.

9 Environmental Impact

A review of the potential environmental impact resulting from the 2021 NMC Design, with cross-reference to the Environmental Statement (ES) submitted in support of the DCO application and environmental documentation submitted to Examination, is discussed below.

The ES submitted in support of the DCO application assessed the following:

- Air Quality;
- Cultural Heritage;
- Landscape;
- Nature Conservation;
- Geology and Soils;
- Materials and Waste;
- Noise and Vibration;
- Effects on All Travellers;
- Community and Private Assets;
- Road Drainage and the Water Environment; and
- Cumulative Effects.

Following a review of the 2021 NMC Design, it has been determined that this Non-Material Change Application needs to consider the potential environmental impact on air quality, noise and vibration, biodiversity, landscape and visual, and water. These are discussed in further detail in the sections below.

It is considered that because there is no increase to construction procedures or any works outside order limits there would be no environmental impact as a result of the 2021 NMC Design on Cultural Heritage, Geology and Soils, Materials and Waste, Effects on All Travellers, or Community and Private Assets. Therefore, in relation to these topics, it is concluded that there are no changes to the assessment of residual effects presented in the ES, and therefore the assessments and conclusions presented in the ES remain valid. These topics are not considered further within this Non-Material Change Application.

Chapter 16 of the ES submitted in support of the DCO application considered combined and cumulative effects.

The former assessed the combined action of different environmental topic-specific impacts upon a single resource/receptor. Consideration of 'in-combination' effects is afforded within the topic change assessments below, where considered relevant.

The latter assessed the combined action of a number of different projects, cumulatively with the project being assessed, on a single resource/receptor. The list of developments included in the cumulative effects assessment was presented in Appendix 16.1 of the ES and was last updated in January 2015 and developments that were accounted for in the traffic model was presented in Appendix 16.2. The locations of the developments were shown on Figure 16.1 of the ES.

A review of relevant planning portals was undertaken in March/April 2021 to determine if any additional developments not in previously considered locations (built or under construction only) within 1km of the 2021 NMC Design, which did not exist within the planning system in January 2015. Such developments would not have been considered in the cumulative effects assessment or the traffic modelling undertaken in support of the DCO application, and therefore, need to be considered for this Non-Material Change Application.

This review concluded that no new committed developments, meeting the selection criteria outlined in Chapter 16 of the ES, are present within 1km of the 2021 NMC Design. Therefore, the cumulative effects assessment and conclusions presented in the ES remain valid.

It should be noted that the ES submitted in support of the DCO application was produced in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. The Regulations were updated in 2017, in accordance with EIA Directive 2014/52/EU, and require consideration of the following additional factors/topics not cited in the 2009 Regulations:

- Climate
- Population and human health
- Major accidents and disasters
- Heat and radiation.

Regarding climate, there are two aspects to consider i) impact of the 2021 NMC Design on climate (greenhouse gas emissions); and ii) vulnerability of the 2021 NMC Design to climate change (adaptation).

In terms of the impact of the 2021 NMC Design on greenhouse gas emissions, analysis of No TJR impacts on the forecast traffic flows along the M4 corridor has shown a small reduction in traffic using the M4 relative to the TJR scenario. At an AADT level, removal of TJR at Junctions 5, 6, 8/9 and 11 has resulted in a reduction in the average traffic flow of less than 900 vehicles per direction, which equates to just over 1% reduction relative to the TJR scenario. The highest reduction in daily traffic (circa 2%) is predicted on the M4 stretch between Junction 8/9 and Junction 5.

At peak hour level, the biggest reductions are predicted in the AM peak, with reductions of around 200 vehicles per hour (circa 3%) on the eastbound section between Junction 8/9 and Junction 5 relative to the TJR scenario. A similar level of flow reduction is predicted between TJR and No TJR scenarios in the PM peak hour in the westbound direction between Junction 5 and Junction 8/9. It is therefore considered that the climate impacts related to greenhouse emissions of the changes, would not be changed in any material way from the emissions arising from the consented Scheme, and if there were changes, they are likely to be a reduction.

The scheme assessed within the 2015 DCO did not include an assessment of embodied carbon as this was not a legislative requirement at the time of submission. However, as the Application is focussed on design changes to the overall scheme and that there is therefore no baseline to compare to, and given that the scheme construction footprint will be less with the proposed design changes, it is assumed that no further assessment of this matter is required to be taken forward; and it is assumed to not be a factor that will affect the materiality of the change.

The 2021 NMC Design (predominantly through its drainage design which has taken account of the appropriate climate change allowances (20%)) has been designed to address vulnerability to climate change (adaption), and therefore vulnerability of the 2021 NMC Design to climate change (adaptation) is not considered further within this Non-Material Change Application.

Therefore, in light of the above, the impact of 2021 NMC Design on climate (greenhouse gas emissions) is not considered further within this Non-Material Change Application.

Regarding population and human health, a Health Impact Assessment was submitted at Deadline III of the DCO Examination, which was informed by the results of the air quality and noise assessments in the ES. Aspects of air quality and noise in respect of the Non-Material Change Application are considered in further detail in the sections below. As a result of the conclusions of that work, no further impacts to population and human health specifically are anticipated from the Non-Material Change Application.

Regarding major accidents and disasters, smart motorway schemes, like any major transport corridor, are considered to be potentially vulnerable to the following major man-made events:

- Industrial accidents such as the Buncefield fire affecting the M1;
- Road accidents involving the spillage of hazardous or polluting materials;
- Civil unrest or terrorist incidents; and
- Aviation accidents such as at East Midlands Airport.

In terms of natural hazards, those of relevance to a motorway relate to extreme adverse weather leading to unsafe driving conditions. Such events may lead to the spillage of fuel or other hazardous materials or those potentially damaging to the aquatic environment such as milk or other substances with a high biochemical oxygen demand.

None of the above major events would require a change to the design of a smart motorway scheme. Indeed, the very nature of a smart motorway scheme with the elevated level of motorway surveillance would mean that the response time to any such incidents would be enhanced and the changes within the Non-Material Change Application would not affect this.

In terms of both man-made and natural major accidents, the incremental environmental risk associated with a smart motorway scheme is the pollution of water quality. However, there is a low probability of a significant impact arising from a low probability major event.

The 2021 NMC Design is not considered vulnerable to risk of major events, nor is there considered to be any consequential changes in the predicted effects of the 2021 NMC Design on environmental factors. Therefore, major accidents and disasters is not considered further within this Non-Material Change Application.

Regarding heat and radiation, the scope of the 2021 NMC Design does not involve the use of radiation. Only under controlled conditions is heat used while the road pavement is laid. Consequently, heat and radiation is not considered further within this Non-Material Change Application.

9.1 Air quality

9.1.1 Introduction

A qualitative change assessment has been undertaken, comparing the 2015 DCO Design with the 2021 NMC Design with reference to the air quality assessment presented in Chapter 6 of the ES submitted in support of the DCO application.

9.1.2 Methodology

The change assessment has considered the potential for traffic changes to occur with the 2021 NMC Design including:

- Total daily flows (annual average daily traffic (AADT));
- Composition (percentage of heavy-duty vehicles (HDVs)); and
- Speed (daily average speed (kph)).

The traffic information used to underpin this assessment is as described in Section 6 of this note. Where traffic AADT flows increase due to the 2021 NMC Design relative to the ES or the numbers of HDVs increase, this could be expected to cause a deterioration in air quality. Alternately, where either AADT flows or HDV numbers reduce with the 2021 NMC Design, this would be expected to improve air quality at nearby receptors. For speed changes, both improvements and deteriorations in air quality could occur. Whether an improvement or deterioration occurs is dependent upon at what speed any predicted variation occurs. In the case of motorway flows along the M4, as

average daily speeds are typically high, a reduction in speed is likely to result in an improvement in air quality.

In order to consider whether a change in any of the traffic metrics may cause a perceptible change in air quality, the same traffic criteria as utilised in the ES have been utilised in this change assessment. These are set out below and as taken from Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07):

- AADT flows will change by 1,000; or
- HDV (vehicles more than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
- Daily average speeds will change by 10 km/h or more.

Under these criteria, only changes in traffic greater than these screening criteria are anticipated to cause a perceptible change in air quality. Any changes in traffic less than these criteria are considered not to be great enough to cause a perceptible change and are considered to be of negligible significance for air quality.

The change assessment has also considered the potential for changes in air quality to occur due to the 2021 NMC Design that could cause the location of vehicles to change. A reduction in the separation of the location of vehicles in running lanes to nearby sensitive receptors could cause a reduction in air quality compared to the predictions presented in the ES. Whilst an increase in separation may cause the converse and an improvement in air quality at nearby sensitive receptors. Whether a change in air quality that is perceptible is anticipated to occur from a change in running lanes location has been considered using the criteria below, taken from DMRB HA 207/07:

- Road alignment will change by 5m or more

Where a change in road width (i.e. running lane) is less than the above screening criteria, then the change in air quality associated with the variation is considered to be imperceptible and of negligible significance for air quality.

9.1.3 Change Assessment Findings

Construction

The scale of the works being undertaken for the 2021 NMC Design are very similar to those in the 2015 DCO Design. Therefore, the potential for adverse effects due to fugitive emissions of dust will be similar with both designs. As such, proposed mitigation measures included within the ES submitted in support of the DCO application and the Construction Environmental Management Plan will be sufficient to mitigate adverse effects on nearby receptors during the construction phase.

Operation

The closest receptors to the 2021 NMC Design are located on the north and south east sides of the junction. The closest receptors to the north of the junction are located on Grampian Way (receptors X23, A422, A423 and A425). As reported in the ES, annual mean concentrations of nitrogen dioxide (NO₂) of 29.8-34.8 µg/m³ were predicted at these receptors with the 2015 DCO Design in operation (Do Something), with increases of 0.6-0.9 µg/m³ compared to without the 2015 DCO Design (Do Minimum). This is well below the annual mean air quality objective of 40 µg/m³.

The closest receptors to the south east of the junction are located on Welland Close (receptors N830, N832, A446, A448, A449, A461 and A462). As reported in the ES, annual mean concentrations of nitrogen dioxide (NO₂) of 31.5-36.8 µg/m³ were predicted at these receptors with the 2015 DCO Design in operation (Do Something), with increases of 0.7-1.0 µg/m³ compared to

without the 2015 Design (Do Minimum). This is below the annual mean air quality objective of 40 µg/m³.

The results of the traffic screening review indicate that at this location, changes in traffic for AADT, HDV and average daily speed are as set out in full in Table 4.

Traffic Data – through junction	Change due to 2015 DCO Design	Change with 2021 NMC Design	Differences between Datasets
AADT (veh/day)	+11,278	+9,151	-2,127
HDV (veh/day)	+490	+302	-188
Average Daily Speed (kph)	+3	-4	-7

Table 4 - Comparison of Traffic Data between the ES (2015 DCO Design) and the 2021 NMC Design Dataset

The anticipated changes are all reductions. This indicates that air quality at nearby receptors may improve compared to the predictions in the ES. As the reduction in AADT flows is greater than the DMRB screening criteria, it is anticipated that a perceptible improvement in nearby receptors could occur.

The comparison of the 2015 DCO Design and the 2021 NMC Design shows the removal of a running lane through junction 5. The approximate width of the removed running lane is 3.75m. This change is less than the 5m DMRB screening criteria; therefore, any change in air quality associated with this variation is expected to be imperceptible and of negligible significance.

9.1.4 Conclusion

The change assessment has identified that traffic changes are overall lower than those predicted in the ES and that changes provided by the 2021 NMC Design are negligible. Considered together, these changes are expected to result overall in a reduced impact on air quality compared to the assessment presented in the ES.

9.2 Noise and vibration

9.2.1 Introduction

A qualitative change assessment has been undertaken, comparing the 2015 DCO Design with the 2021 NMC Design with reference to the noise and vibration assessment presented in Chapter 12 of the ES submitted in support of the DCO application and the Enhanced Noise Mitigation Study Report submitted at Deadline VII and revised at Deadline VIII of the DCO Examination.

9.2.2 Changes in Baseline

Subsequent changes in traffic flows on the M4 and surrounding roads since the ES was submitted in support of the DCO application would affect the Do Minimum (i.e. without the scheme) and Do Something (i.e. with the scheme) traffic flows in similar ways.

Consequently, the negligible or minor noise level reductions reported in the ES and the Enhanced Noise Mitigation Study Report would still be evident and therefore the assessment and conclusions presented in both documents remain valid.

As shown in the ES and the Enhanced Noise Mitigation Study Report, there are negligible or minor noise level reductions with the scheme in operation. Consequently, there will be no adverse significant effects on any new committed developments within the junction 5 study area (although none have been identified) resulting from the implementation of the 2021 NMC Design, as the change to No TJR results in a reduction in noise levels – see Figure 6 below.

9.2.3 Location and Sensitive Receptors

Figure 5, below, shows junction 5 and the surrounding area. There are large residential areas to the north, north west and south east of the junction, along with a large hotel immediately to the north west of the junction.



Figure 5 Junction 5 and Surrounding Area

9.2.4 Change Assessment Findings

Construction Noise and Vibration

Given that three lanes are being retained through the junction, the mainline works through the junction will be less intensive than for TJR. Consequently, surrounding sensitive receptors will not experience any additional significant effects as a result of the construction of the 2021 NMC Design compared to construction of the 2015 DCO Design.

Construction of the eastbound on-slip will be short term compared to the overall duration of construction works in this area. With the implementation of good site practices, these works will result in no additional significant effect on the nearest residential properties (which lie immediately to the north) when compared to the 2015 DCO Design.

Consequently, adoption of the 2021 NMC Design will not result in significant changes to the overall construction noise and vibration levels to sensitive receptors in the vicinity when compared to the 2015 DCO Design.

Operational Noise

The noise change assessment has employed the following scenarios along with their traffic data sets;-

- 1) Do Something 2022 With Through Junction Running (DS22 With TJR)
- 2) Do Something 2022 Without Through Junction Running (DS22 No TJR)

The traffic information used to underpin this assessment is as described in Section 6 of this note. The above scenarios have been implemented in a detailed computer noise model. The model has been used to calculate noise level contours within a study area around the 2021 NMC Design for each scenario, from which noise level changes between scenarios can be derived.

Figure 6, below, shows the noise level changes (DS22 No TJR) minus (DS22 With TJR).

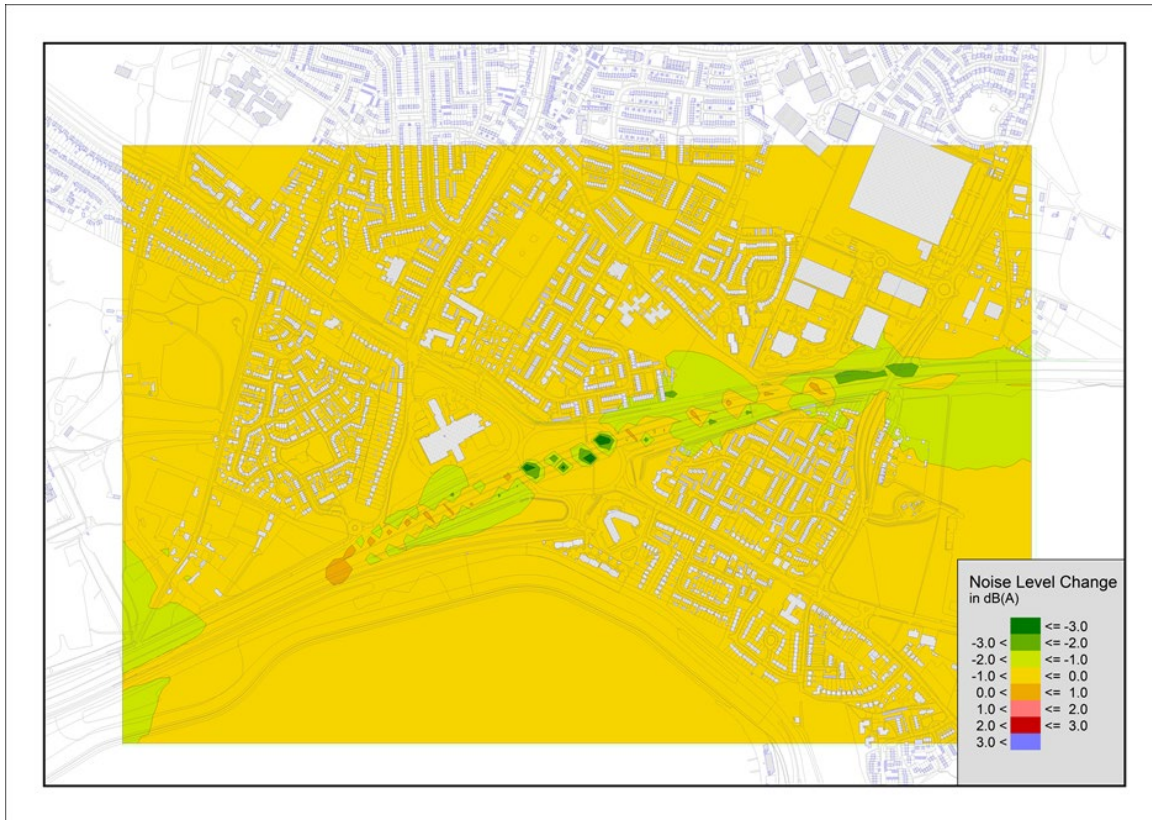


Figure 6 Noise level changes (DS22 No TJR) minus (DS22 With TJR)

It can be seen that there are generally negligible noise level decreases across the surrounding area as a result of adopting No TJR when compared with TJR.

It is noted that the long-term traffic flows (DS37 No -TJR) show a similar trend to the short-term traffic flows (DS22 No TJR), when compared to the corresponding TJR traffic flows. As a result, there is no requirement to consider the long term-noise level changes separately.

Consequently, adoption of the 2021 NMC Design will not result in significant changes to the overall operational noise levels to sensitive receptors in the vicinity when compared to the 2015 DCO Design.

9.2.5 Conclusion

The qualitative change assessment has concluded that the 2021 NMC Design will not result in any significant construction noise and vibration level changes or operational noise level changes to surrounding receptors when compared with the 2015 DCO Design. It is therefore concluded that there are no changes to the assessment of residual effects presented in the ES, nor are there any changes to the assessment presented in the Enhanced Noise Mitigation Study Report, and therefore the assessment and conclusions presented in the ES and the Enhanced Noise Mitigation Study Report remain valid.

9.3 Biodiversity

9.3.1 Introduction

A qualitative change assessment has been undertaken, comparing the 2015 DCO Design with the 2021 NMC Design with reference to the ecology and nature conservation assessment presented in Chapter 9 of the ES submitted in support of the DCO application. The change assessment considered the potential impacts of changes to vegetation clearance on designated sites, habitats, and protected species.

Two sites of European importance to nature conservation were scoped into the impact assessment for the scheme; screening revealed no direct or indirect effects on these sites, their qualifying features, or their conservation objectives. The 2021 NMC Design changes are small scale in nature and do not materially alter the original assessments and there is no change to the conclusion of No Likely Significant Effect on these statutory designated sites. These sites have not been considered further in this assessment.

9.3.2 Methodology

The qualitative change assessment has been undertaken to enable direct comparison with the assessment presented in Chapter 9 of the ES.

The study area comprises the area within the Order limits around the 2021 NMC Design between chainages 18+200 and 22+700.

The change assessment has been undertaken in two stages:

- The first stage comprised a change assessment of the impacts of the 2021 NMC Design using the baseline ecological information that informed the ES, to enable a 'like for like' comparison of the effects of the 2021 NMC Design against the effects of the 2015 DCO Design.
- The second stage comprised a change assessment of the impacts of the 2021 NMC Design using the baseline ecological information that informed the ES, as well as any relevant updated ecological information collected since (up to 30 March 2021), to provide a current change assessment of the potential effects of the 2021 NMC Design.

The following data sources have been consulted:

- Chapter 9 of the ES (and associated appendices and figures) submitted in support of the DCO application
- Ecological Constraints geodatabase (as of 30 March 2021) (A database that contains information collected pre-construction and by Ecological Clerks of Works during site clearance and construction)
- Vegetation clearance drawings submitted at Deadline VII of the DCO Examination (514451-MUH-ML-ZZ-DR-SC-301248 to 514451-MUH-ML-ZZ-DR-SC-301250; Sheets 24 to 26; revision 6F 04/02/2016)
- 2021 NMC Design Vegetation Clearance Drawings (ELS-SZ_ZZZZZZZZ_Z-DR-LD-5323 to ELS-SZ_ZZZZZZZZ_Z-DR-LD-5325; Sheets 23 to 25; 2022 revision P01)
- 2021 NMC Design Environmental Masterplan Drawings (ELS-SZ_ZZZZZZZZ_Z-DR-LD-5247 to ELS-SZ_ZZZZZZZZ_Z-DR-LD-5251; Sheets 47 to 51; 2022 revision P01)

The change assessment considers impacts during construction only, as the 2021 NMC Design would not result in any significant changes to operational impacts. Whilst the air quality change assessment (see Section 9.1) concludes a beneficial change in air quality with the 2021 NMC Design, this is not considered to be significant in relation to biodiversity as there are no sensitive designated site receptors within the 200 m threshold for potential significance.

The mitigation measures referred to in this change assessment are those secured through the made DCO, with consideration given as to whether any additional mitigation is required as a result of the 2021 NMC Design.

9.3.3 Change Assessment Findings

Summary of design changes in relation to biodiversity

The 2021 NMC Design would result in an overall moderate increase in permanent vegetation clearance and a slight increase in temporary vegetation clearance, mainly through additional strips of permanent and temporary vegetation clearance along the verges.

Additional areas of habitat that would be lost include small areas of broad-leaved plantation woodland, scattered trees, dense scrub, scattered scrub, species-poor hedgerows, ditches, tall ruderal herbs, improved grassland, and amenity grassland. These areas are located adjacent and parallel to existing carriageways and nearly all are only a few metres wide. The value of these areas to nature conservation is compromised by their small size, poor connectivity to other valuable natural habitats, high levels of disturbance, and lack of management. Areas of temporary vegetation clearance would be replanted with woodland, trees, scrub, shrubs, open grassland, and amenity grassland, which would offset most of the habitat loss.

Impact change assessment using DCO baseline ecological information

The ecological receptors within the study area assessed in the ES comprised designated sites, habitats and plants (including an area of ancient woodland), invasive species, amphibians, reptiles, birds, bats, and badger (*Meles meles*). Table 5 below presents a summary of the assessment of the 2015 DCO Design presented in the ES and a change assessment of the 2021 NMC Design for these receptors using the DCO baseline ecological information.

The significance of residual effects of the 2021 NMC Design on designated sites, habitats and plants (including ancient woodland), invasive species, birds, bats, and badger when assessed against the DCO baseline ecological information is **neutral**, which represents no change from the assessment of the 2015 DCO Design presented in the ES (**neutral**).

The significance of residual effects of the 2021 NMC Design on amphibians and reptiles when assessed against the DCO baseline ecological information is **slight adverse**, which represents no change from the assessment of the 2015 DCO Design presented in the ES (**slight adverse**).

The 2021 NMC Design would not contribute to any change to in-combination or cumulative effects.

The mitigation as listed in Table 5 and described within the ES remains appropriate and sufficient. These mitigation measures are included within the current version of the Construction Environmental Management Plan (as discharged under Requirement 8 of the DCO).

Impact change assessment using current baseline ecological information

Since the submission of the ES, further information relating to invasive species, amphibians, reptiles, bats, and badger has been recorded within the study area. Table 5 below presents a change assessment of the 2021 NMC Design using this current baseline ecological information.

The significance of residual effects of the 2021 NMC Design on designated sites, habitats and plants (including ancient woodland), invasive species, birds, bats, and badger when assessed against the current ecological baseline is **neutral**, which represents no change from the assessment of the 2015 DCO Design presented in the ES (**neutral**).

The significance of residual effects of the 2021 NMC Design on amphibians and reptiles when assessed against the current ecological baseline is **slight adverse**, which represents no change from the assessment of the 2015 DCO Design presented in the ES (**slight adverse**).

No additional committed developments were identified with potential for cumulative effects.

The 2021 NMC Design would not contribute to any change to in-combination or cumulative effects.

The mitigation as listed in Table 5 (below), and described within the ES, remains appropriate and sufficient. These mitigation measures are all included within the current version of the Construction Environmental Management Plan (as discharged under Requirement 8 of the DCO). The Construction Environmental Management Plan will be updated accordingly at the next six-month review.

9.3.4 Conclusion

The qualitative change assessment has concluded that the 2021 NMC Design will not result in any change to the significance of residual, in-combination, or cumulative effects on biodiversity receptors compared to the 2015 DCO Design, when assessed using either the DCO ecological baseline or the current ecological baseline. It is therefore concluded that there are no changes to the assessment of residual effects presented in the ES and therefore the assessment and conclusions presented in the ES remain valid.

Ecological receptor	Summary of ES assessment of '2015 DCO Design'				Summary of '2021 NMC Design' change assessment using DCO baseline	Changes to ES baseline	Summary of '2021 NMC Design' change assessment using current baseline				Comments
	Value	Impact Description	Mitigation	Significance of Residual Effect	Significance of Residual Effect		Value	Impact Description	Mitigation	Significance of Residual Effect	
Designated sites	Local	Pollution	Best practice pollution prevention and control	Neutral No residual effects	Neutral No residual effects (No change to avoidance of vegetation clearance within the Queen Mother Reservoir Local Wildlife Site (LWS), and best practice pollution control measures would remain sufficient to avoid any other localised effects.)	None	Local	Pollution	Best practice pollution prevention and control	Neutral No residual effects (No change to avoidance of vegetation clearance within the Queen Mother Reservoir LWS, and best practice pollution control measures would remain sufficient to avoid any other localised effects.)	
Habitats and plants	Local	Habitat loss Pollution	Minimising works areas Replanting Best practice pollution prevention and control	Neutral Habitat loss	Neutral Habitat loss (Habitats to be lost are still considered to be of local value for nature conservation, and habitat loss, whilst slightly increased, is still minor. Replanting in areas of temporary vegetation clearance would offset habitat loss and best practice pollution control measures would remain sufficient to avoid any other effects to surrounding retained habitats.)	None	Local	Habitat loss Pollution	Minimising works areas Replanting Best practice pollution prevention and control	Neutral Habitat loss (Habitats to be lost are still considered to be of local value for nature conservation, and habitat loss, whilst slightly increased, is still minor. Replanting in areas of temporary vegetation clearance would offset habitat loss and best practice pollution control measures would remain sufficient to avoid any other effects to surrounding retained habitats.)	
Habitats - ancient woodland	National	None	None required	Neutral No residual effects	Neutral No residual effects (No change to effects on ancient woodland.)	None	National	None	None required	Neutral No residual effects (No change to effects on ancient woodland.)	

Ecological receptor	Summary of ES assessment of '2015 DCO Design'				Summary of '2021 NMC Design' change assessment using DCO baseline	Changes to ES baseline	Summary of '2021 NMC Design' change assessment using current baseline				Comments
	Value	Impact Description	Mitigation	Significance of Residual Effect	Significance of Residual Effect		Value	Impact Description	Mitigation	Significance of Residual Effect	
Invasive species	N/A	Spread	Species-specific control measures	Neutral No residual effects	Neutral No residual effects (Species-specific control measures remain sufficient to control spread of invasive plant species.)	Giant Hogweed (<i>Heracleum mantegazzianum</i>) recorded at 19+050 EB Indian (Himalayan) Balsam (<i>Impatiens glandulifera</i>) recorded at 21+800 EB, 21+725 EB, and 21+550 EB Japanese Knotweed (<i>Fallopia japonica</i>) recorded at 19+500 WB and between 18+390 and 18+425 WB	N/A	Spread	Species-specific control measures	Neutral No residual effects (Species-specific control measures remain sufficient to control spread of invasive plant species.)	

Amphibians	Local	Habitat loss	<p>Pre-construction survey</p> <p>Phased vegetation clearance</p> <p>Seasonal avoidance</p>	<p>Slight adverse</p> <p>Minor permanent loss of foraging habitat</p>	<p>Slight adverse</p> <p>Minor permanent loss of foraging habitat (Still considered to be minor due to low value and small areas of habitats to be lost.)</p> <p>(Phased vegetation clearance would remain sufficient to avoid direct mortality.)</p>	<p>Pond 27 with excellent habitat suitability for great crested newt (<i>Triturus cristatus</i>) and now with presence assumed located just outside the site boundary at 21+020 EB</p> <p>Pond 20/21 with excellent habitat suitability for great crested newt and now with presence assumed located approximately 180m north of the site boundary at 18+250 EB</p> <p>Low great crested newt risk zone associated with Pond 27 present between 21+275 and 20+750 EB</p> <p>Low great crested newt risk zone (associated with ponds 20/21, 18, and 17) present between 18+725 and 18+425 EB</p> <p>Medium great crested newt risk zone (associated with ponds 20/21, 18, and 17) present between 18+425 and 18+000 EB</p>	Local	Habitat loss	<p>Pre-construction survey</p> <p>Phased vegetation clearance</p> <p>Seasonal avoidance</p>	<p>Slight adverse</p> <p>Minor permanent loss of foraging habitat (Still considered to be minor due to low value and small areas of habitats to be lost.)</p> <p>(Ponds 27, 20/21, 18, and 17 were included on the contractor's great crested newt licence (2018-35524-EPS-MIT) granted in 2018, which includes the agreed mitigation solution. In the licence and the CEMP, phased vegetation clearance includes provision for hand searches of refugia in high and medium risk zones. This would remain sufficient to avoid direct mortality.)</p>	
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Ecological receptor	Summary of ES assessment of '2015 DCO Design'				Summary of '2021 NMC Design' change assessment using DCO baseline	Changes to ES baseline	Summary of '2021 NMC Design' change assessment using current baseline				Comments
	Value	Impact Description	Mitigation	Significance of Residual Effect	Significance of Residual Effect		Value	Impact Description	Mitigation	Significance of Residual Effect	
Reptiles	Local	Habitat loss	Displacement Translocation	Slight adverse Displacement and translocation of individuals Minor permanent loss of foraging habitat	Slight adverse Displacement and translocation of individuals (Phased vegetation clearance or translocation would remain sufficient to avoid direct mortality.) Minor permanent loss of foraging habitat (Still considered to be minor due to low value and small areas of habitats to be lost.)	Suitable and highly optimal reptile habitat recorded between 22+250 - 22+450 EB Suitable but sub-optimal reptile habitat recorded between 22+400 - 22+500 WB	Local	Habitat loss	Displacement Translocation	Slight adverse Displacement and translocation of individuals (Phased vegetation clearance or translocation would remain sufficient to avoid direct mortality.) Minor permanent loss of foraging habitat (Still considered to be minor due to low value and small areas of habitats to be lost.)	
Birds	Local	Habitat loss	Seasonal avoidance (or pre-construction survey) Replanting	Neutral No residual effects	Neutral No residual effects (No change to effects on birds.)	None	Local	Habitat loss	Seasonal avoidance (or pre-construction survey) Replanting	Neutral No residual effects (No change to effects on birds.)	
Bats	Local	Habitat loss	Pre-construction survey Minimising light spill Replanting	Neutral No residual effects	Neutral No residual effects (Replanting would offset habitat loss.)	Ashley Arch Culvert and Ditton Road Culvert, downgraded to no bat roost suitability	Local	Habitat loss	Pre-construction survey Minimising light spill Replanting	Neutral No residual effects (Replanting would offset habitat loss.)	
Badger	Negligible	Habitat loss	Replanting	Neutral No residual effects	Neutral No residual effects (Replanting would offset habitat loss.)	Sett 004, now classified as a disused subsidiary sett, located at 20+190 WB within J5	Negligible	Habitat loss	Replanting	Neutral No residual effects (Replanting would offset habitat loss.)	

Table 5 - Biodiversity impact change assessment

9.4 Landscape and visual

9.4.1 Introduction

A qualitative landscape and visual impact change assessment comparing the change in design between the 2015 DCO Design and the 2021 NMC Design has been conducted.

The change assessment has considered the landscape and visual impacts of changes to vegetation clearance and planting proposals on sensitive receptors.

This was based on the assumption that the sensitive receptors could be most affected by changes in views of the motorway, due to additional vegetation clearance and therefore less mitigation planting and as an outcome, less visual buffer between the change and the sensitive receptor.

9.4.2 Methodology

The change assessment of landscape change between the 2015 DCO Design and the 2021 NMC Design has been undertaken in four stages:

Stage 1

Identify the landscape and visual effects of the 2015 DCO Design for this specific area using information presented in the following documents:

- Chapter 8: Landscape of the ES submitted in support of the DCO application, which provides information on the predicted temporary landscape and visual effects during construction, the predicted permanent landscape and visual effects during operation, and predicted cumulative effects.
- Appendix 8.3: Visual Effects Schedule of the ES submitted in support of the DCO application, which provides detailed information on the predicted visual effects during both construction and operation.
- Environmental Masterplan submitted at Deadline VIII of the DCO Examination (Version 11F, 29/02/2016).

Stage 2

Compare the 2015 DCO Design identified on the Environmental Masterplan submitted at Deadline VIII of the DCO Examination (Version 11F, 29/02/2016) with the relevant detailed landscape design shown on the ENGINEERING AND DESIGN REPORT, ENVIRONMENTAL MASTERPLAN (P01, S2, HA514451-CHHJ-ELS-SZ_ZZZZZZZZ_Z-DR-LD-5200 to 5265, 18/02/22) and vegetation clearance shown on the NON-MATERIAL CHANGE VEGETATION CLEARANCE (P01, S2, HA514451-CHHJ-ELS-SZ_ZZZZZZZZ_Z-DR-LD-5300 to 5331, 18/02/22) and identify any changes to vegetation clearance, landscape proposals and visual setting of sensitive visual receptors as a result of the 2021 NMC Design, using the baseline information presented in the ES.

Stage 3

Review the baseline information presented in the ES to determine any changes since the ES was published, focussing on the following sensitive receptors:

- Residential properties
- Business and institutional properties
- Listed Buildings
- Conservation Areas
- Scheduled Monuments

- National Character Areas (NCAs)
- Landscape Character Areas (LCAs)
- Landscape designations (e.g. AONB)
- Public rights of way (PRoW)
- National Trails.

Stage 4

Assess the impacts of the 2021 NMC Design against the current baseline (as of April 2021) in recognition that the baseline may have changed since the publication of the ES. Where the effects on the current baseline differ from the effects on the ES baseline (see Stage 2), provide an explanation of that change.

9.4.3 Change Assessment Findings

Stage 1

The following sensitive visual receptors, potentially impacted by the design change associated with the 2021 NMC Design, were identified in the ES and on the Environmental Masterplan submitted at Deadline VIII of the DCO Examination (Version 11F, 29/02/2016), as illustrated on Figure 7 (from west to east):

- Riding Court Road Overbridge (western end) - #1
- Junction 5: Langley Interchange- #2
- Home Farm Stream (eastern end) - #3

The following sensitive visual receptors were identified within the ES:

- Residential properties on Sovereign Heights- #4
- Residential properties on Regency Court on Grampian Way (Langley) - #5
- Residential properties on Trent Way, off Sutton Lane (Brands Hill), - #6
- Residential properties on Little Sutton Lane, - #7
- One residential property, eastbound at chainage 19+200.000. - #8

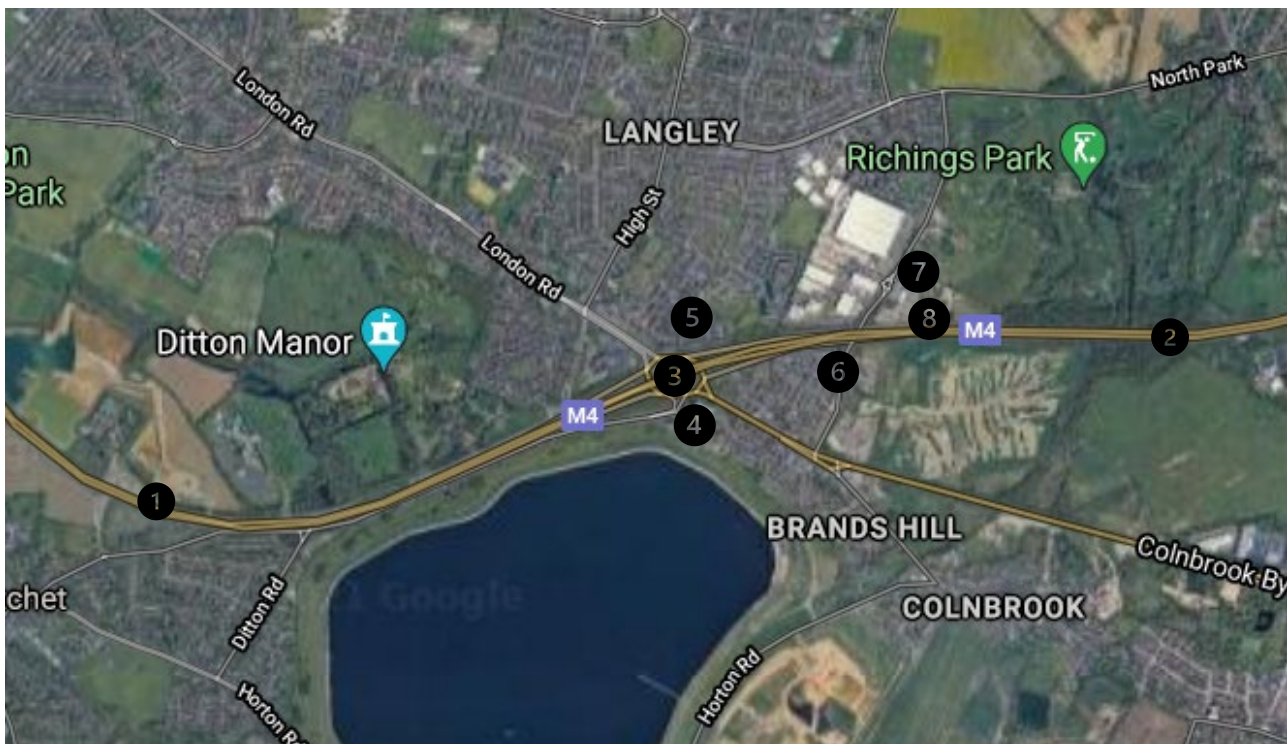


Figure 7 Aerial Image of assessment area showing sensitive receptors as identified in the ES

Chapter 8 of the ES presented the assessment of the residual landscape and visual effects on a 'link by link' basis. Junction 5 falls within the links of junction 6 to 5 – NCA 115 (Thames Valley) and junction 5 to 4b – NCA 115 (Thames Valley).

Table 6 below presents the residual effects assessment for junction 6 to 5 and junction 5 to 4b, taken from Table 8.2 of the ES.

	Impact Description	Receptors Affected	Mitigation	Significance of Residual Effect
Scheme Link	Junction 6 to 5 – NCA 115 (Thames Valley) and Junction 5 to 4b – NCA 115 (Thames Valley)			
Temporary Impacts (Construction)	Construction impacts resulting from overbridge realignments, earthworks strengthening and new gantries.	Landscape receptors: LCA 13d: Datchet Langley urban area Urban area at junction 5. Visual Receptors: Residential properties on Sovereign Heights Residential properties on Regency Court on Grampian Way (Langley) Residential properties on Trent Way, off Sutton Lane (Brands Hill), Residential properties on Little Sutton Lane	Construction best practice to minimise disruption, e.g. protection of retained existing vegetation, including trees covered by TPOs or within conservation areas lying immediately adjacent to the Order limits.	Landscape Moderate adverse on landscape Slight adverse the urban area Visual amenity Moderate adverse to major adverse
Permanent Impacts (Operation)	Presence of gantries on embankment *Removal of gantry in close proximity to residential properties	Landscape receptors: None affected. Visual Receptors: Residential properties on Sovereign Heights Residential properties on Regency Court on Grampian Way (Langley) Residential properties on Trent	Woodland (EE L2.9) and new tree and shrub planting (EE L2.3) to replace the vegetation lost.	Landscape Neutral Visual amenity Moderate adverse reducing over time to slight adverse or neutral. *Slight beneficial

	Impact Description	Receptors Affected	Mitigation	Significance of Residual Effect
Scheme Link	Junction 6 to 5 – NCA 115 (Thames Valley) and Junction 5 to 4b – NCA 115 (Thames Valley)			
		Way, off Sutton Lane (Brands Hill), Residential properties on Little Sutton Lane *One residential property, eastbound at chainage 19+200.000.		
Cumulative Impacts	Gravel extraction at Riding Court Farm Rail/road freight interchange	None affected	None required	Neutral

Table 6 Residual effects assessment for junction 6 to 5 and junction 5 to 4b, taken from Table 8.2 of the ES

Stage 2

A change assessment of the residual landscape and visual effects of the 2021 NMC Design against the baseline information presented in the ES is presented in Tables 6, 7 and 8 with a summary of the changes provided below.

Change to Vegetation Clearance

Riding Court Road Overbridge: Additional vegetation clearance in the north eastern and western quadrant due to drainage works and bridge approach works. However, the remaining existing vegetation provides sufficient screening towards Riding Court Farm and Ditton Park Registered Park and Garden.

Residential properties on Sovereign Heights: No additional vegetation clearance.

Residential properties on Regency Court on Grampian Way (Langley): No additional vegetation clearance.

Residential properties on Trent Way, off Sutton Lane (Brands Hill): No additional vegetation clearance.

Residential properties on Little Sutton Lane: No additional vegetation clearance.

Changes to Landscape Proposals

Only at Riding Court Road Overbridge, due to minor additional clearance, the landscape proposals changed to ensure that screening to sensitive receptors is provided.

Changes to Gantries - Visual Amenity

G3-05: eastbound removed, westbound changed to ADS cantilever.

G4-07: no change to original assessment.

G4-08: removed.

G3-14a: New since discharge of 2018 DCO Requirements: exposed as on top of embankment and close to residential areas, no possibility to screen.

G4-03: no change to original assessment.

Stage 3

After reviewing the area east and west of the 2021 NMC Design, no changes to the baseline information presented in the ES have been identified.

Stage 4

Tables 7,8 and 9 below present:

- The findings of the assessment of residual landscape and visual effects previously reported in the ES.
- The findings of the change assessment of residual landscape and visual effects of the 2021 NMC Design against the baseline information presented in the ES.
- A summary of any changes to the baseline information presented in the ES since the ES was published.
- The findings of the change assessment of residual landscape and visual effects of the 2021 NMC Design against the current baseline (as of April 2021).
- An explanation of any differences in the change assessment of effects on the current baseline when compared to the assessment of effects on the ES baseline.

Temporary Impacts during Construction

	Summary of ES Assessment of '2015 DCO Design'				Summary of '2021 NMC Design' change assessment using ES baseline	Changes to ES baseline	Summary of '2021 NMC Design' change assessment using current baseline			Comments
	Impact Description	Receptors Affected	Mitigation	Significance of Residual Effect	Significance of Residual Effect		Impact Description	Mitigation	Significance of Residual Effect	
Scheme Link	Junction 6 to 5 – NCA 115 (Thames Valley) and Junction 5 to 4b – NCA 115 (Thames Valley)									
Temporary Impacts (Construction)	Construction impacts resulting from overbridge realignments, earthworks strengthening and new gantries.	<u>Landscape Receptors:</u> LCA 13d: Datchet Langley urban area Urban area at junction 5 <u>Visual Receptors:</u> Riding Court Overbridge Residential properties on Sovereign Heights Residential properties on Regency Court on Grampian Way (Langley) Residential properties on Trent Way, off Sutton Lane (Brands Hill), Residential properties on Little Sutton Lane	Construction best practice to minimise disruption, e.g. protection of retained existing vegetation, including trees covered by TPOs or within conservation areas lying immediately adjacent to the Order limits.	<u>Landscape</u> Moderate adverse on landscape Slight adverse on the urban area <u>Visual amenity</u> Riding Court Overbridge: N/A Others: Moderate adverse to major adverse	<u>Landscape</u> Moderate adverse on landscape Slight adverse the urban area <u>Visual amenity</u> Riding Court Overbridge: N/A Others: Moderate adverse to major adverse	<u>Landscape</u> No additional sensitive receptors have been identified <u>Visual</u> Minor additional vegetation clearance	Although some changes to vegetation clearance no change of landscape character as the area has still varying levels of tranquillity, with the busy M4 cutting the landscape and creating a significant visual and audible impact. The M4 dissects the character area centrally, and provides a major transport corridor through the landscape.	Protection of retained existing vegetation, including trees covered by TPOs within and immediately adjacent to the Order limits and within a conservation area.	<u>Landscape</u> Moderate adverse on landscape Slight adverse on the urban area <u>Visual amenity</u> Riding Court Overbridge: Slight adverse Others: Moderate adverse to major adverse	The conclusion of the ES assessment remains valid

Table 7 – Temporary Landscape and Visual Impacts during Construction

Permanent Impacts during Operation

	Summary of ES Assessment of '2015 DCO Design'				Summary of '2021 NMC Design' change assessment using ES baseline	Changes to ES baseline	Summary of '2021 NMC Design' change assessment using current baseline			Comments
	Impact Description	Receptors Affected	Mitigation	Significance of Residual Effect	Significance of Residual Effect		Impact Description	Mitigation	Significance of Residual Effect	
Scheme Link	Junction 6 to 5 – NCA 115 (Thames Valley) and Junction 5 to 4b – NCA 115 (Thames Valley)									
Permanent Impacts (Operation)	<p>Presence of gantries on embankment</p> <p>*Removal of gantry in close proximity to residential properties</p>	<p><u>Landscape Receptors:</u></p> <p>LCA 13d: Datchet</p> <p>Langley urban area</p> <p>Urban area at Junction 5</p> <p><u>Visual Receptors:</u></p> <p>Riding Court Overbridge</p> <p>Residential properties on Sovereign Heights</p> <p>Residential properties on Regency Court on Grampian Way (Langley)</p> <p>Residential properties on Trent Way, off Sutton Lane (Brands Hill),</p> <p>Residential properties on Little Sutton Lane;</p>	<p>Construction best practice to minimise disruption, e.g. protection of retained existing vegetation, including trees covered by TPOs or within conservation areas lying immediately adjacent to the Order limits.</p> <p>Woodland (EE L2.9) and new tree and shrub planting (EE L2.3) to replace the vegetation lost</p>	<p><u>Landscape</u></p> <p>Moderate adverse reducing over time to slight adverse</p> <p><u>Visual amenity</u></p> <p>Riding Court Overbridge:</p> <p>N/A</p> <p>*One residential property, eastbound at chainage 19+200.000:</p> <p>*Slight beneficial</p> <p>Others:</p> <p>Moderate adverse reducing over time to slight adverse or neutral.</p>	<p><u>Landscape</u></p> <p>Moderate adverse reducing over time to slight adverse</p> <p><u>Visual amenity</u></p> <p>Riding Court Overbridge:</p> <p>N/A</p> <p>*One residential property, eastbound at chainage 19+200.000:</p> <p>*Slight beneficial</p> <p>Others:</p> <p>Moderate adverse reducing over time to slight adverse or neutral</p>	<p><u>Landscape</u></p> <p>No additional sensitive receptors have been identified</p> <p><u>Visual</u></p> <p>Minor additional vegetation clearance</p>	<p><u>Landscape</u></p> <p>Although some changes to vegetation clearance no change of landscape character as the area has still varying levels of tranquillity, with the busy M4 cutting the landscape and creating a significant visual and audible impact. The M4 dissects the character area centrally, and provides a major transport corridor through the landscape.</p> <p><u>Visual</u></p> <p>Additional vegetation clearance in the north eastern and western quadrant compared with the original EMP due to scheme development during construction, including drainage works and bridge approachment works. However, the remaining existing vegetation provides sufficient screening towards Riding Court Farm and Ditton Park RPG.</p>	<p>Woodland (EE L2.9) and new tree and shrub planting (EE L2.3) to replace the vegetation lost wherever possible</p>	<p><u>Landscape</u></p> <p>Moderate adverse reducing over time to slight adverse</p> <p><u>Visual amenity</u></p> <p>Riding Court Overbridge:</p> <p>N/A</p> <p>*One residential property, eastbound at chainage 19+200.000:</p> <p>*Slight beneficial</p> <p>Others:</p> <p>Moderate adverse reducing over time to slight adverse or neutral</p>	<p>The conclusion of the ES assessment remains valid</p>

Table 8 – Permanent Landscape and Visual Impacts during Operation

Cumulative Impacts

	Summary of ES Assessment of '2015 DCO Design'				Summary of '2021 NMC Design' change assessment using ES baseline	Changes to ES baseline	Summary of '2021 NMC Design' change assessment using current baseline			Comments
	Impact Description	Receptors Affected	Mitigation	Significance of Residual Effect	Significance of Residual Effect		Impact Description	Mitigation	Significance of Residual Effect	
Scheme Link	Junction 6 to 5 – NCA 115 (Thames Valley) and Junction 5 to 4b – NCA 115 (Thames Valley)									
Cumulative Impacts	Gravel extraction at Riding Court Farm Rail/road freight interchange	<u>Landscape Receptors:</u> None affected <u>Visual Receptors:</u> None affected	None required	<u>Landscape</u> Neutral <u>Visual amenity</u> Neutral	<u>Landscape</u> Neutral <u>Visual amenity</u> Neutral	No additional sensitive receptors have been identified	<u>Landscape</u> None identified <u>Visual amenity</u> None identified	None required	<u>Landscape</u> Neutral <u>Visual amenity</u> Neutral	The conclusion of the ES assessment remains valid

Table 9 – Cumulative Landscape and Visual Impacts

Summary

Regarding temporary impacts during construction, it is concluded that there are:

Riding Court Road Overbridge: Slight adverse impact due to additional vegetation clearance.

Residential properties on Sovereign Heights: No change.

Residential properties on Regency Court on Grampian Way (Langley): No change.

Residential properties on Trent Way, off Sutton Lane (Brands Hill): No change.

Residential properties on Little Sutton Lane: No change.

Regarding permanent impacts during operation, it is concluded that there are:

Riding Court Road Overbridge: Slight adverse impact at Riding Court Road Overbridge due to minor additional vegetation clearance. Replacement planting of tree and shrubs for mitigation will permanently screen the area from views.

Sensitive receptors and along mainline: No change.

Gantries:

For a detailed gantry specific change assessment, refer to **Appendix A**.

G3-05: eastbound removed: slight beneficial.

Westbound changed to ADS cantilever: no change to original assessment.

G4-07: no change to original assessment.

G4-08: removed: slight beneficial.

G3-11: ADS signs added from removed G3-092: neutral.

G3-14a (new): exposed as on top of embankment and close to residential areas, no possibility to screen: moderate adverse. This should be perceived in the context of the wider link assessment which has always identified a moderate adverse effect for the link, as such there are no changes to the ES conclusions.

G4-03: no change to original assessment.

There are no changes to the assessment of temporary residual effects during construction presented in the ES as a result of the 2021 NMC Design when considering either the baseline information presented in the ES or the current baseline.

Additional vegetation clearance is negligible for the sensitive receptors identified and would not change the visual amenity for the sensitive receptors.

There are no changes to the assessment of permanent residual effects during operation presented in the ES as a result of the 2021 NMC Design when considering either the baseline information presented in the ES or the current baseline. Additional vegetation clearance is negligible for sensitive receptors identified and would not change the visual amenity for the sensitive receptors.

There are no changes to the assessment of cumulative impacts presented in the ES as a result of the 2021 NMC Design when considering either the baseline information presented in the ES or the current baseline.

9.4.4 Conclusion

The 2021 NMC Design has been assessed against the baseline information presented in the ES and the current baseline (as of April 2021) and has been compared against the assessment of residual effects presented in the ES submitted in support of the DCO application.

It is concluded that there are no changes to the assessment of residual effects presented in the ES, and therefore the assessment and conclusions presented in the ES remain valid.

9.5 Water

9.5.1 Introduction

A qualitative change assessment of the 2021 NMC Design has been undertaken. Two aspects have been considered. The current water environment baseline has been appraised to identify any changes since the ES was submitted in support of the DCO application. The change assessment has also considered whether there are any changes to the residual effects reported in Chapter 15 of the ES, interpreting whether these are due to changes in the baseline status of water environment receptors or due to the 2021 NMC Design.

9.5.2 Methodology

The change assessment has considered the potential for the 2021 NMC Design to cause:

- Changes to flood impacts due to a change in the footprint of works within the floodplain, as defined by Environment Agency Flood Zones 2 and 3 and/or a change to a proposed watercourse crossing. The 2015 Flood Zone extents have been reviewed against current (2021) flood maps available online¹.
- Changes to pollution effects from accidental spillages and routine runoff during operation because of changes to traffic flows and/or the proposed drainage design. The water quality of watercourses receiving discharges of runoff has been reviewed with reference to current (Cycle 2) Water Framework Directive data published online².
- Changes to groundwater due to a change in the footprint of works within a Source Protection Zone (SPZ) or overlying a Principal Aquifer.

9.5.3 Change Assessment Findings

Review of Baseline Conditions

The future baseline described in the ES assumed improvements in surface and groundwater quality driven by implementation of the Water Framework Directive (WFD). However, review of the most recently available data shows that for the surface waterbody local to junction 5 (Datchet Common Brook), there has been no change or a degradation in some aspects of its water quality. The WFD groundwater body (the Lower Thames Gravels) is at the same status as reported in the ES with regard to its chemical quality.

There have been no changes to the spatial extents of Flood Zones 2 (medium risk) and 3 (high risk) in the vicinity of junction 5.

Changes in the baseline qualities of water environment receptors local to junction 5 are therefore limited. The value/sensitivity assigned to receptors, in accordance with the criteria set out in Table 15.2 of the ES, would be the same or lower.

¹ Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)

² Environment Agency - Catchment Data Explorer

Review of Design Changes

The 2021 NMC Design is located within Environment Agency Flood Zone 1, defined as having an annual probability of flooding from rivers and the sea of less than 0.1%. The 2021 NMC Design will therefore not affect any fluvial floodplains. No watercourses flow perpendicular to the M4 at junction 5, and therefore new watercourse crossings at this location were not part of the assessment presented in the ES. The 2021 NMC Design does not change this. The effects of the 2021 NMC Design on flood impacts are neutral.

Changes to traffic flows have been assessed. The anticipated changes to AADT traffic flows and the number of HDV vehicles are all reductions, albeit the magnitude of the reductions is relatively small (see Section 9.1 above). Consequently, there would be a minor reduction in the risk of pollution of receiving watercourses due to accidental spillages and from the discharge of routine runoff.

In the ES, the significance of effects on water quality due to road drainage discharges was qualitatively assessed accounting for mitigation measures to ensure no deterioration compared to the baseline. Subsequently, as part of detailed design, DMRB HD 45/09 assessments incorporating HAWRAT (risk assessment on surface watercourses), groundwater risk assessments and accidental spillage risk assessments were carried out at all outfalls.

At junction 5, the accidental spillage risk assessment and groundwater pollution risk assessment confirm that the risk level is acceptable, and no further spillage containment or mitigation measures are necessary at existing outfalls to prevent baseline water quality deterioration. The assessments have also demonstrated that long-term, statutory water quality standards, defined by the Environmental Quality Standards for dissolved copper and zinc, are met. Short-term impacts defined by runoff specific thresholds (RSTs) for dissolved copper and zinc, as well as the degree of sedimentation at outfalls, were both at an acceptable level. At some outfalls, the drainage design changes would deliver improvements, whilst at other outfalls, RST exceedances would be similar to and no worse than baseline conditions.

The DMRB HD 45/09 assessments therefore confirm that the impact of the 2021 NMC Design on water quality would be neutral.

The 2021 NMC Design is situated within an outer (3) groundwater SPZ. The underlying bedrock geology does not support an aquifer, but local superficial geology supports a Principal Aquifer. The 2021 NMC Design would reduce the scale and footprint of construction works, for example negating the need to widen underbridges and a subway. The potential for effects on groundwater flows, levels and groundwater quality would therefore be reduced, with the 2021 NMC Design overall representing a minor beneficial change for groundwater receptors.

9.5.4 Conclusion

It is concluded that there are no changes to the assessment of residual effects presented in the ES, apart from a minor beneficial change for groundwater, and therefore the assessment and conclusions presented in the ES remain valid.

10 Conclusion

Through traffic modelling, operational, safety and environmental change assessments, and considering customer disruption, it has been found that the most suitable solution for junction 5 as part of the scheme is to implement a No TJR arrangement. The operational appraisal has found that peak hour traffic flows do not justify 4 lanes, and that the projected traffic flows can be accommodated into the existing 3 lanes.

As a result of adopting a no TJR arrangement at junction 5, the location and types of gantries (and as appropriate CCTV and POPs) associated with the junction have required changing.

The 2021 NMC Design (inclusive of the gantry changes) does not change the overall assessment of residual effects presented in the ES submitted in support of the DCO application, nor does it change the environmental documentation submitted in support of the DCO application and environmental documentation submitted to Examination. Therefore, the assessment and conclusions presented in the ES remain valid.

Appendix A. Gantry visual impact assessment

Gantry Ref.	Scheme Chainage	Height (m above Finished Road Level)	Status	Design Year (2037) Effects on Views	Design Year (2037) Effects on landscape character	Comment
G3-05	18+398	9.9	New	Neutral	Neutral	Set in context of adjacent mature tree belt outside the Order limits and remote away high sensitivity receptors
		12.8				
G4-07	22+505	10.4	New	Neutral	Neutral	Set in the context of the Riding Court Road overbridge, replacement planting and remote from high sensitivity receptors
G4-08	22+275	9.2	New	Slight adverse	Neutral	Visible from residential properties (eastbound)
G3-11	19058		existing	n/a	n/a	n/a
G3-14a	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
G4-03	21157	13.4	New	Neutral	Neutral	Although visible in open views from transient users of the local cycle route (westbound) the gantry is set in the context of a view dominated by the foreground M4 and associated traffic

Table 10 2015 Gantry Visual Assessment

Gantry Ref.	Scheme Chainage	Height (m above Finished Road Level)	Status	Design Year (2037) Effects on Views	Design Year (2037) Effects on landscape character	Comment
G3-05	18+398	n/a	New	n/a	n/a	Eastbound removed
		13		Neutral	Neutral	changed to ADS cantilever WB
G4-07	22+505	13.5	New	Slight adverse	Neutral	Plus MS4
G4-08	Removed since 2017	n/a	n/a	n/a	n/a	Removed from scheme since 2017
G3-11	19058	n/a	N/A	Neutral	Neutral	ADS signs added from removed G3-092
G3-14a	19975	9.2	New	Moderate Adverse	Moderate Adverse	New to 2021 NMC Design
G4-03	21155	13.4	New	Neutral	Neutral	Change from Super-span to Super Cantilever.

Table 11 2022 Gantry Visual Change Assessment