# 6. The Proposed Scheme

## 6.1 Introduction

6.1.1 This chapter provides a description of the Design Manual for Roads and Bridges (DMRB) Stage 3 design of the proposed scheme as assessed and reported in the Environmental Impact Assessment Report (EIAR), including a summary of the likely methods and programme of its construction.

6.1.2 Background is also provided in this chapter on the anticipated procurement process, Transport Scotland's sustainable development policy for the A9, and on existing and projected traffic conditions.

## 6.2 Background

**Scheme Procurement**

6.2.1 The proposed scheme is planned to be procured by means of a Design and Build (D&B) type contract. Under the terms of this contract type, the Contractor will undertake both the detailed design and construction of the proposed scheme. Responsibility for operating and maintaining the trunk road would remain with the Scottish Government. Responsibility for operating and maintaining side roads would remain with Perth & Kinross Council (PKC) on completion of the proposed scheme. Both the Scottish Government and PKC may appoint agents to operate and maintain the respective road networks on their behalf.

6.2.2 Under a D&B type contract, a specimen (outline) design is prepared for the proposed scheme, which the appointed Contractor(s) can optimise as the detailed design is developed. Such optimisation must be within the constraints imposed by the EIAR including the Schedule of Environmental Commitments (Chapter 22), which contains the mitigation measures identified through the EIA process; Statutory Orders (such as land acquisition); and any specific limits set within the contract documents. This will ensure that the detailed design will be implemented in compliance with this EIAR.

6.2.3 Optimisation of the proposed scheme design will still be deemed to comply with this EIAR provided that any design changes have been subject to environmental review to ensure that the residual effects would not result in a significant effect not reported in this EIAR or a non-significant residual effect reported in this EIAR changing to a significant residual effect, and subject to Transport Scotland's acceptance of the design changes and the findings of any such review.

**Sustainable Development Policy**

6.2.4 Consideration of sustainable development issues have and will continue to form an important element of all activities undertaken in the proposed scheme's life cycle, including:

- project design and appraisal;

- procurement;
- construction;
- maintenance; and
- operation (and decommissioning).

6.2.5 The A9 Dualling SEA Post Adoption Statement (Transport Scotland, 2014) included a range of Environmental Design Principles, based on a review of relevant plans, policies and strategies. The agreed environmental principles were reported in full through the Post Adoption Statement. These environmental principles include several of particular relevance to sustainable development, including:

- promote local/sustainable sourcing of materials;
- promote sustainable design and innovation to reduce material consumption;
- avoid and minimise waste generation; and
- maximise re-use of material resources and use of recycled materials.

6.2.6 The A9 Dualling Sustainability Strategy (Transport Scotland, 2016a) aims to deliver the A9 Dualling programme as a model of modern infrastructure development, with sustainability embedded through all stages of the delivery process. The sustainability vision for the A9 Dualling programme is to deliver:

*'An A9 that connects people, business and communities, respects the natural environment of the corridor and makes a contribution to creating a successful and sustainable Scotland.'*

## 6.3 Traffic Conditions

6.3.1 The existing traffic conditions of the current A9 carriageway are noted in Section 2.4 (Local Context for Dualling), paragraph 2.4.8 of Chapter 2 (Need for the Scheme), based on 2023 data. A full explanation of the transport modelling approach is provided in the A9 Dualling Pass of Birnam to Tay Crossing DMRB Stage 3 Report (Transport Scotland, 2025) in Section 5 (Transport Modelling Approach).

6.3.2 The proposed scheme as part of the A9 Dualling programme is classed as the 'Do-Something' scenario. Traffic forecasting techniques were applied to enable the traffic impacts of the A9 Dualling to be considered against the 'Do-Minimum' scenario (i.e. if the proposed scheme were not to proceed). Traffic projections were provided as the latest available (2018 outputs of the Transport Model for Scotland (TMfS)). TMfS is a strategic modelling tool, developed and made available by Transport Scotland for the purposes of assessing the influences of land-use and transport policies on traffic demand. Two traffic growth scenarios are available: these are 'With Policy' and 'Without Policy' scenarios. The 'With Policy' scenario assumes that a reduction in car kilometres by 20% by 2030 at a national level is achieved. Note that this is not the same as cutting the traffic on each and every road by 20%. The 'Without Policy' scenario effectively assumes that traffic levels continue to increase.

6.3.3 There is unlikely to be a significant volume of induced traffic and strategic rerouting during the period to 2035, when the A9 Dualling programme will be complete. Induced traffic is the term used to describe the phenomenon where an increase in the capacity of a road releases a latent demand for travel and results in an increase in traffic on the road following the upgrade. This is unlikely to be significant when works are ongoing elsewhere on the A9 between Perth and Inverness and therefore the Do-Minimum and Do-Something flows on the A9 are therefore likely to be similar up to 2035. Following completion of the final project in the A9 Dualling programme, the full benefits of upgrading the route to dual carriageway standard will begin to be realised.

6.3.4 Hence, the assessment years adopted for operational assessment are 2036 and 2051. 2036 is the assumed first year of operation even although it is anticipated that the Pass of Birnam to Tay Crossing project will be completed before this date. 2051 is the Design Year, as it is 15 years after the assumed first year of full programme operation in accordance with DMRB guidelines.

6.3.5 The flow in 2051, 15 years after the first full year of operation (2036) of the A9 Dualling programme, includes the effect of the full A9 Dualling programme and is considered to represent the most robust (worst-case scenario) figures for the purposes of the EIA as reported in this EIAR. Table 6.1 details the Do-Minimum and Do-Something Annual Average Daily Traffic (AADT) flows on the Pass of Birnam to Tay Crossing section of the A9 Dualling programme for the 'With Policy' growth scenario and Table 6.2 contains data for the 'Without Policy' growth scenario. AADT follows are the average flows over a full year of the number of vehicles passing a point in the road network each day rounded to the nearest 100. Growth rates are derived before rounding the flows. For the purposes of this EIAR, and in accordance with the precautionary principle, the AADT flows data used are from the 'Without Policy' growth scenario.

**Table 6.1: AADT Flows for Pass of Birnam to Tay Crossing (With Policy Scenario)**

| Location | Do-Minimum | | | | Do-Something | |
|---|---|---|---|---|---|---|
| | Year 2015 | Year 2025 | Year 2036 | Year 2051 | Year 2036 | Year 2051 |
| Southern Extent of Project 2 | 15,600 | 15,200 | 14,700 | 15,200 | 16,200 | 16,800 |
| A9 between Birnam/Murthly and Dunkeld Junction | 14,900 - 15,000 | 14,700- 14,800 | 14,300 - 14,400 | 14,800 - 14,900 | 15,400 | 16,100 |
| A9 between Dunkeld Junction and The Hermitage | 14,900 | 14,600 | 14,200 | 14,700 | 16,000 | 16,600 |
| A9 between The Hermitage and Dalguise Junction | 15,000 | 14,700 | 14,200 | 14,700 | 16,000 | 16,600 |

| Location | Do-Minimum | | | | Do-Something | |
|---|---|---|---|---|---|---|
| | Year 2015 | Year 2025 | Year 2036 | Year 2051 | Year 2036 | Year 2051 |
| Northern Extent of Project 2 | 14,600 | 14,300 | 13,800 | 14,400 | 15,500 | 16,100 |
| Overall Growth (with respect to year 2015) | - | -2% - -2% | -6% - -4% | -3% - -1% | 3% - 7% | 7% - 11% |
| Overall Increase (with respect to Do Minimum) | - | - | - | - | 7% - 13% | 8% - 13% |
| Growth rate per annum (with respect to Do Minimum) | - | -0.2% - -0.2% | -0.3% - -0.2% | -0.1% - 0% | 0.1% - 0.3% | 0.2% - 0.3% |

**Table 6.2: AADT Flows for Pass of Birnam to Tay Crossing (Without Policy Scenario)**

| Location | Do-Minimum | | | | Do-Something | |
|---|---|---|---|---|---|---|
| | Year 2015 | Year 2025 | Year 2036 | Year 2051 | Year 2036 | Year 2051 |
| Southern Extent of Project 2 | 15,600 | 15,700 | 17,900 | 21,400 | 20,500 | 25,000 |
| A9 between Birnam/Murthly and Dunkeld Junction | 14,900 - 15,000 | 15,100- 15,200 | 17,200 - 17,200 | 20,500 - 20,600 | 19,400 | 23,700 |
| A9 between Dunkeld Junction and The Hermitage | 14,900 | 15,100 | 17,200 | 20,500 | 20,200 | 24,700 |
| A9 between The Hermitage and Dalguise Junction | 15,000 | 15,200 | 17,200 | 20,600 | 20,200 | 24,700 |
| Northern Extent of Project 2 | 14,600 | 14,800 | 16,800 | 20,100 | 19,600 | 24,000 |
| Overall Growth (with respect to year 2015) | - | 1% - 2% | 14% - 15% | 36% - 38% | 29% - 35% | 58% - 66% |
| Overall Increase (with respect to Do Minimum) | - | - | - | - | 13% - 18% | 15% - 21% |

| Location | Do-Minimum | | | | Do-Something | |
|---|---|---|---|---|---|---|
| | Year 2015 | Year 2025 | Year 2036 | Year 2051 | Year 2036 | Year 2051 |
| Growth rate per annum (with respect to Do Minimum) | - | 0.1% - 0.2% | 0.6% - 0.7% | 0.9% | 1.2% - 1.5% | 1.3% - 1.4% |

## 6.4 Description of the Proposed Scheme

6.4.1 An overview of the proposed scheme design assessed within this EIAR is shown on Figure 6.1, with engineering drawings showing the horizontal and vertical alignment of the proposed scheme provided in Annex A of Appendix A6.1 (Construction Information). Throughout this EIAR, references are made to chainage (shortened to 'ch', for example ch1500), which is a reference to the number of metres from the starting point of the proposed scheme, from south to north. Chainages are also shown on the EIAR Figures and referred to in the description below.

6.4.2 As explained in Chapter 4 (Alternatives Considered), the preferred route for the proposed scheme was identified following the DMRB Stage 2 Route Option Assessment, which included an assessment of the potential environmental constraints associated with a number of route options. This was then subject to iterative design development as summarised in Chapter 5 (Iterative Design Development), taking into account of the recommendations of environmental specialists, input from the consultation process, and the results of traffic, structural, geotechnical and drainage studies.

6.4.3 The existing 8.4km single carriageway section of the A9 from Pass of Birnam to Tay Crossing is to be widened to an all-purpose rural dual carriageway. The proposed scheme has been designed as Dual 2 lane All-purpose road (D2AP) with design speed of 120kph, in accordance with DMRB CD109 – Highway Link Design (Highways England, 2020). The proposed scheme provides two lanes in each direction, separated by a central reserve; a more detailed description is provided in the following sections. Full details of the DMRB Stage 3 design of the proposed scheme are available in the DMRB Stage 3 Scheme Assessment Report (Transport Scotland, 2025) and engineering drawings showing the horizontal and vertical alignment of the proposed scheme are provided in Annex A of Appendix A6.1 (Construction Information).

**A9 Mainline Carriageway Widening**

6.4.4 The mainline will comprise of a dual carriageway with minimum 2.5m verges and two lanes of 3.65m width in each direction, plus a 1m hardstrip to both the nearside and offside lanes in each direction and a typically 2.5m wide central reservation separating each carriageway. Both the verges and central reserve will be widened as necessary for visibility. Technical engineering detail on the carriageway cross-sections utilised within the DMRB Stage 3 design are provided within the DMRB Stage 3 Scheme Assessment Report Part 2: Engineering, Traffic and Economic Assessment (Transport Scotland, 2025).

6.4.5 The existing A9 mainline has several direct accesses linking to side roads and to land and properties along the route. Once the existing A9 is upgraded to dual carriageway, the majority of these accesses will be stopped up to meet the desired design and safety standards. As explained in paragraphs 6.4.6 to 6.4.13, alternative access to and from the A9 mainline will be provided by two grade separated junctions, an at-grade roundabout, three at grade left in/left out junctions, and via the existing side road and access track network.

**A9 Junction Provision**

6.4.6 There are two grade separated junctions included as part of the proposed scheme, as follows:

- The Birnam Junction (ch1900) replaces the existing at-grade junction and provides a northbound merge, a northbound diverge and a southbound merge facilitating connection to the B867 and Perth Road.
- The Dalguise Junction (ch6800) replacing the existing at-grade junction and provides a northbound merge and diverge loop, a southbound merge and diverge facilitating full vehicle movement and connection with the B898.

6.4.7 It should be noted that the Dalguise junction will facilitate junction movements that will be provided by the A9 Southern Tie-in Interim Roundabout in the Tay Crossing to Ballinluig project. This roundabout is assumed in the baseline for this EIAR and the roundabout will be removed as part of the proposed scheme.

6.4.8 There is one roundabout on the main alignment to be provided as part of the proposed scheme, as follows:

- The Dunkeld Junction at-grade roundabout (ch4100) replacing the existing at-grade junction and that will facilitate connection to the A9 (north and south), A923, A822 (Old Military Road) and the Unclassified Road to Inver, and includes a segregated left turn lane from the A923 to the A9 southbound.

6.4.9 There are three left-in left-out junctions on the main alignment to be provided as part of the proposed scheme, as follows:

- A left-in left-out junction (ch3000 northbound) replacing the existing at-grade junction to Dunkeld & Birnam Station and providing maintenance access to Dunkeld and Birnam Station Building and Network Rail assets, including the signalling box and the road/rail access point.
- Upgrade of the existing access to The Hermitage with the Hermitage Left-in Left-out Junction (ch5200 northbound) providing access to the National Trust for Scotland beauty spot and car park.
- A new left-in left-out for the Inver Maintenance Access (North) (ch5500 southbound) providing access to a SuDS features and farmland (replacing the existing gated access).

**Side Road Amendments/Upgrades**

6.4.10 Side roads will be upgraded as necessary to provide access from the existing road network to the mainline of the proposed scheme. Upgrades may involve simple resurfacing or may require realignment and other improvements.

6.4.11 Table 6.3 details the proposed side road cross-sections forming part of the proposed scheme. Chapter 16 (Population – Land Use) outlines the anticipated route changes people travelling to residential areas and commercial/industrial businesses would experience as a result of the side road amendments.

**Table 6.3: Proposed Side Road Cross-sections**

| Side road name | Approximate mainline chainage | Cross-section |
|---|---|---|
| B867 / Perth Road | ch1750 - ch2500 | 6m carriageway, 1m hardstrips, 2.5m verges (minimum) |
| Station Road | ch3380 | As existing |
| Perth Road | ch3870 - ch4010 | As existing |
| A822 (Old Military Road) | ch3940 - ch4040 | 6m carriageway, 1m hardstrips, 2.5m verges (minimum) |
| A923 | ch4040 - ch4100 | 7.3m carriageway, 1m hardstrips, 2.5m verges (minimum) |
| Unclassified Road to Inver | ch4100 - ch4290 | 6m carriageway, 1m hardstrips, 2.5m verges (minimum) |
| B898 | ch6760 - ch7510 | 6m carriageway, 1m hardstrips, 2.5m verges (minimum) |

**Access to Land and Properties**

6.4.12 A number of properties, including farms, farmland and woodland are located along the proposed scheme. Through consultation with residents and landowners, revised accesses are proposed to tie into the existing road network or onto the A9 main carriageway via the grade separated, at-grade junctions and side road amendments described in paragraphs 6.4.6 to 6.4.11.

6.4.13 Table 6.4 details the cross-sections for the revised access provision forming part of the proposed scheme.

**Table 6.4: Proposed Access Cross-sections**

| Access name | Approximate mainline chainage | Cross-section |
|---|---|---|
| Murthly Estate Access Track | ch100 - ch1030 | 3.5m carriageway, 6m verge and passing places |
| Sewage Works Access Track | ch2370 - ch2440 | 4m carriageway |
| Station Building Access Track | ch2930 - ch3370 | 3.5m carriageway (minimum), 0.5m verges (minimum) |
| Birnam Glen | ch3450 | As existing |
| Inver Maintenance Access Track (South) | ch4350 - ch4930 | 3.5m carriageway, 0.5m verges |
| Inver Maintenance Access Track (North) | ch5370 - ch5550 | 3.5m carriageway, 0.5m verges |
| Inverwood Access Track (South) | ch6270 - ch6800 | 3.5m carriageway, 0.5m verges |
| Inverwood Access Track (North) | ch6800 - ch7340 | 3.5m carriageway, 0.5m verges |

**Provision for Walkers, Wheelers, Cyclists and Horse Riders**

6.4.14 Existing and proposed walkers, wheelers, cyclists and horse rider (WCH) route alignments have been considered throughout the design process and form part of the proposed scheme design. WCH was formerly referred to as non-motorised users (NMU) and for the purposes of this EIAR are considered as the same. The NMU Access Strategy (Transport Scotland, 2016b) sets out several objectives with regards to WCH access provision during construction and operation as part of the A9 Dualling programme and which have been considered throughout the design development of the proposed scheme. This links back to Objective 3 outlined in Section 2.4 (A9 Dualling Programme Review) (Chapter 2 (Need for the Scheme)), providing the ability to 'facilitate active travel within the corridor' of the proposed scheme.

6.4.15 The routes that currently cross the existing A9 were derived from the PKC Core Path Plan (PKC, 2012), Right of Way data from Scotways, and local designated and undesignated paths identified by Jacobs through consultation. In considering the baseline for this EIAR, WCH improvements promoted by Network Rail at Dunkeld & Birnam Station were assumed to be completed. These relate to both platform raising works and provision of step free access between Platform 1 and Platform 2 via ramps and footways linking to Birnam Glen Road. Further details are provided in Chapter 17 (Population - Accessibility); the proposed WCH provisions across the proposed scheme are illustrated on Figure 17.2 and include:

- ch100 – ch1000: Realignment of Local Path along Murthly Estate Access Track;
- ch1300 – ch1920: New WCH provision between local paths at Dalpowie Plantation and the local path and core path DUNK/10 south of Sewage Works;

- ch1720 – ch2500: New WCH provision in northbound verge of the B867 between core path DUNK/14 and the proposed Sewage Works Access Track, then in the southbound verge of Perth Road to the north of the Sewage Works Access Track;
- ch2100 – ch3040: Realignment of core path Dunk/142 and National Cycle Route NCN77 between the northbound verge of the B898 and the northbound verge of the A9 Dual carriageway, then in the northbound verge of the A9 Dual Carriageway, and then adjacent to the Network Rail Maintenance Access Track before joining Birnam Glen;
- ch2320 – ch2430: Realignment of core path DUNK/57 between the realigned core path DUNK/142 and the railway underpass;
- ch2350 – ch2400: Realignment of core path DUNK/10 along Sewage Works Access Track;
- ch3340 – ch3380: New WCH provision between the top of Station Road and Platform 1 of Dunkeld and Birnam Station;
- ch3380 – ch3450: Realigned local path between the top of Station Road and Birnam Glen Road;
- ch3420 – ch3450: WCH provision between Dunkeld and Birnam Station (Platform 1) and Birnam Glen Road;
- ch3940 – ch4240: New WCH provision in the southbound verge of the A822 roundabout arm, crossing into the northbound verge of the A822 arm, then continuing in the northbound verge of the roundabout and Unnamed Road to Inver;
- ch3960 – ch4000: Realigned WCH route in southbound verge of junction between the A923 and Perth Road;
- ch4000 – ch4020: Realigned core path DUNK/59 in northbound verge of junction between the A923 and Little Dunkeld Road;
- ch4120 – ch4310: Realignment of core paths DUNK/59 and DUNK/23 along proposed footpath between Dunkeld and Birnam Sports and Leisure Hub and the Unclassified Road to Inver;
- ch4150 – ch4620: New WCH provision in the southbound verge of the Unnamed Road to Inver roundabout arm and then in the northbound verge of the A9 Dual Carriageway to the proposed northbound bus layby;
- ch4250 – ch4700: New WCH provision between the realigned core path DUNK/59 and the northbound verge of the A9 Dual Carriageway, and then in the southbound verge of the A9 Dual Carriageway to the proposed southbound bus layby;
- ch4310 – ch4920: Realigned core paths DUNK/137 and DUNK/23 along Inver Maintenance Access Track (South);
- ch4380 – ch4510: New WCH provision between the proposed southbound bus layby and the end of the Inver Maintenance Access Track (South);
- ch4400 – ch4690: New WCH provision between the proposed northbound bus layby and the Inver Maintenance Access Track (South);
- ch4680 – ch4910: New WCH provision between the proposed southbound bus layby and core path DUNK/23 on the southern bank of the River Tay;

- ch5110 – ch5250: Realignment of core path DUNK/64 alongside northbound carriageway between Inver and The Hermitage;
- ch6800 – ch7400: New WCH provision in the southbound verge of the B898 between Inverwood Access Track (North) and core paths DUNK/23 and DUNK/65;
- ch7040 – ch7120: New WCH provision between the Inverwood Access Track (North) and core path DUNK/23 on the western bank of the River Tay;
- ch6800 – ch7800: Realigned core path DUNK/100 and National Cycle Route NCN77 from the existing River Tay Crossing (Jubilee Bridge) to the new River Tay Bridge;
- ch7740 – ch7800: Realigned core path DUNK/145 and National Cycle Route NCN77 to connect core paths DUNK/145 and DUNK/100 and provide route utilising the River Tay Bridge, Inverwood Access Track (North), Inverwood Access Track (North) Rail Bridge, and Dalguise Junction to connect to the B898; and
- ch8260 – ch8310: Realigned local path around base of proposed earthworks.

**Bus Stop Provision**

6.4.16 There are two bus stops on the existing A9 at Inver and eight further bus stops on Perth Road as shown on Figure 16.1. The bus stops at Inver will be replaced by the proposed scheme as permanent bus stops (northbound and southbound) on the main alignment (ch4500 to ch4700). The proposed scheme will support connection to the existing bus stops on Perth Road and will also provide opportunity for bus turning and bus stop facilities at the replacement Dunkeld & Birnam Station car park.

**Bridges**

6.4.17 There are 10 bridges in the proposed scheme. The structures design of these will be informed by strategic design guidance that has been prepared for the A9 Dualling. The 10 bridges are:

- Murthly Estate Bridge (new structure providing access to Murthly Estate);
- Birnam Junction Bridge (new structure forming part of the Birnam Junction);
- Birnam Glen and Inchewan Burn Bridge (new structure supporting the main alignment crossing Birnam Glen and Inchewan Burn);
- River Braan Bridge (new structure for the main alignment with WCH provision crossing the River Braan);
- Inver Rail Bridge (extension to existing structure to cross the Highland Main Line railway);
- Dalguise Junction Bridge (new structure forming part of Dalguise Junction);
- Inverwood Access Track (North) Rail Bridge (new structure to allow vehicle and WCH access under the Highland Main Line railway);
- Inch Rail Bridge (extension to existing structure to cross over the Highland Main Line railway);
- River Tay Bridge (new structure for the southbound carriageway across the River Tay and incorporating provision for WCH); and

- River Tay Crossing (Jubilee Bridge) (existing structure maintained supporting the northbound carriageway).

**Underpass Structures**

6.4.18 One pedestrian underpass is included in the proposed scheme. This is the Dunkeld & Birnam Station Pedestrian Underpass providing connection from the replacement car park at the top of Station Road to Platform 1 and Platform 2 of Dunkeld & Birnam Station. The underpass structure will include stairs and lifts and be fully accessible for walkers, wheelers and cyclists.

**Earthworks**

Cuttings and Embankments

6.4.19 The vertical profile of the DMRB Stage 3 design for the proposed scheme aims to maintain a level as close to existing ground level as possible. Where the design of the proposed scheme carriageway is higher or lower than the surrounding ground level, embankments or cuttings will be required. Reducing the gradient of embankments (referred to as 'grading out') has been considered along the route to reflect local landform and aspects such as surrounding land use or other environmental constraints. Similarly, cuttings have been designed to take account of their visibility for road users and others along the A9 corridor. Further information on the appearance of embankments and cuttings is provided in Chapter 10 (Landscape).

6.4.20 The location (chainages) of the key cuttings and embankments in the DMRB Stage 3 design are shown on Figure 6.1 and summarised in Table 6.5 and Table 6.6 respectively.

**Table 6.5: Key Road Cuttings in DMRB Stage 3 Design**

| Chainage (m) Start | Chainage (m) End | Anticipated Max Depth (m) | Anticipated Slope Gradient *(v = vertical, h = horizontal)* |
|---|---|---|---|
| -350 | 0 | 14.3 | 1v : 2h to 2.5h |
| 740 | 1000 | 9.3 | 1v : 2h |
| 1000 | 1650 | 8.0 | 1v : 2h to 2.5h |
| 1800 | 2400 | 17.5 | 1v : 0.23h to 4h |
| 3230 | 3450 | 4.8 | 1V : 1.6h to 2h |
| 3490 | 4000 | 14.5 | 1v : 0.91h to 2h |
| 4990 | 5250 | 8.75 | 1v : 3h |
| 6190 | 6490 | 27.6 | 1v : 1h to 2h |
| 6500 | 7100 | 20.9 | 1v : 2h to 2.5h |
| 7200 | 7410 | 16.8 | 1v : 1h to 2h |
| 7860 | End | 14.0 | 1v : 1h |

**Table 6.6: Key Road Embankments in DMRB Stage 3 Design**

| Chainage (m) Start | Chainage (m) End | Anticipated Max Height (m) | Anticipated Slope Gradient (v = vertical, h = horizontal) |
|---|---|---|---|
| 0 | 860 | 8.7 | 1v : 2h to 18.5h |
| 1620 | 2070 | 9.0 | 1v : 2h to 2.5h |
| 2360 | 3330 | 11.1 | 1v : 0.36h to 2h |
| 4000 | 4300 | 4.8 | 1v : 1h to 2h |
| 4380 | 4920 | 7.6 | 1v : 1.31h to 2h |
| 5250 | 5500 | 11.2 | 1v : 2h to 3h |
| 5760 | 7420 | 16.4 | 1v : 0.36h to 13.5 |

Earthworks Balance

6.4.21 A summary of the estimated earthworks quantities for construction of the proposed scheme is provided below in Table 6.7, with further details of material use and management of waste during construction provided in Chapter 14 (Material Assets and Waste). Estimates are based on available Ground Investigation (GI) information and assume 90% acceptability of the site won soil and rock. The estimated volume of surplus cut material includes acceptable and unacceptable surplus materials and rock.

**Table 6.7: Estimated Earthworks Volumes**

| Site Won Material | Total Volume ($m^3$) | Unacceptable Material($m^3$) | Available for Re-Use ($m^3$) | Required ($m^3$) | Surplus Acceptable Material ($m^3$) |
|---|---|---|---|---|---|
| Soil and Rock | 1,105,104 | 110,510 | 994,593 | 672,809 | 321,784 |
| Topsoil | 151,189 | 15,119 | 136,070 | 37,774 | 92,296 |
| **Total** | **1,256,293** | **125,629** | **1,130,664** | **710,583** | **420,080** |

**Fencing and Environmental Barriers**

Fencing

6.4.22 To secure the land area acquired for the implementation of the proposed scheme, temporary fencing will be erected prior to the commencement of construction, where appropriate. There is likely to be a requirement for stock-proof fencing in some areas, where pastureland bounds the proposed scheme.

6.4.23 A highway fencing that would stretch the full length of the proposed scheme is not a requirement for an all-purpose A-class road. On completion of the works, delineating road infrastructure such as SuDS features and areas of roadside planting from adjacent land may be required to maintain the utilisation of retained farmland or forestry land. Additionally, fencing for ecological purposes may also be required such as mammal fencing to prevent or discourage mammals from entering the highway boundary. Where the proposed scheme requires land-take from private property and housing, replacement fencing would also be erected.

Environmental Barriers

6.4.24 Environmental barriers are required to reduce the potential impacts of the proposed scheme at specific locations. Where a requirement has been identified within this EIAR, environmental barriers will be incorporated to provide mitigation for mammals (including otter and badger fencing) or noise attenuation. These are described respectively in Chapter 12 (Biodiversity) and Chapter 15 (Noise and Vibration), and their locations are shown on Figure 10.6: Landscape and Ecological Mitigation.

**Drainage Design and Watercourse Crossings**

6.4.25 The proposed drainage design and proposals for watercourse crossings take into consideration the Water Environment (Controlled Activities) Regulations 2011 (CAR) (Scottish Government, 2011). These regulations require certain licences to be sought for design and construction activities affecting watercourses, including engineering works (culverts and bridges) and discharges (outfalls, attenuation and treatment). The watercourse crossings and drainage design which forms part of the proposed scheme have been discussed with SEPA in the context of CAR requirements. and further details are contained in Chapter 19 (Road Drainage and the Water Environment) and Appendix A19.3 (Watercourse Crossing Report).

6.4.26 The proposed scheme is located within the River Tay catchment and crosses 16 surface water features. The majority of these are steep, cascading low stream order watercourses characterised by step/pool sequences with cobble, pebble and/or gravel substrates, or artificial drainage channels, and which currently feature culverted crossings associated with the existing A9.

6.4.27 The largest watercourse within the study area is the River Tay, which is a partially embanked mobile gravel-bed river. The River Braan within the study area forms part of the River Tay Special Area of Conservation (SAC).

6.4.28 It is currently intended that Transport Scotland will provide the Contractor(s) with draft CAR licence applications based on the DMRB Stage 3 design. The appointed Contractor(s) will have responsibility for submitting finalised applications and securing CAR authorisation based on their detailed design.

Drainage Design and Flooding

6.4.29 The drainage design for the proposed scheme has been developed in accordance with Sustainable Drainage Systems (SuDS) guidance and through consultation with SEPA and PKC, outlined in Chapter 7 (Consultation and Scoping). In certain areas along the existing A9 there are lengths of filter drain in the verges that provide initial (one SuDS level) treatment for some of the run-off from the road and/or adjacent earthworks slopes. Construction drainage is discussed in Appendix A6.1.

6.4.30 A minimum of two levels of SuDS is intended to be included for all mainline outfalls in agreement with SEPA. There are eight drainage catchments (Catchments A, B2, C2, D, E, G and I) that fully meet the SuDS Design Principles as detailed in Appendix A10.7 (SuDS Design Principles). The following four additional drainage catchments have SuDS departures because two levels of treatment using conventional SuDS was not possible:

- SuDS within the functional floodplain without inundation protection to prevent the loss of floodplain storage and associated flood risk (catchments F and H);
- adoption of proprietary SuDS in the form of hydrodynamic vortex separators (to treat runoff) and geocellular attenuation tanks (to attenuate flows) due to insufficient space either adjacent to, or at a reasonable distance from, the proposed scheme to accommodate conventional SuDS treatments (catchment C1); and
- discharging to minor watercourses due to hydrogeology constraints and the desire to minimise impacts to the River Tay Special Area of Conservation (SAC) (catchment B1).

6.4.31 However, two levels of proprietary treatment are achieved in these drainage catchments, and SEPA has been consulted on the drainage proposals and additional information is provided in Chapter 19 (Road Drainage and the Water Environment).

6.4.32 The proposed drainage system makes use of combined surface and groundwater filter drains to provide most of the carriageway drainage. Exceptions to this include kerbed areas, such as junctions and bridge decks where gullies or combined kerb/drainage units would be used to collect surface water. As part of the drainage system, a series of ponds, basins and swales are included in the proposed scheme design to control the discharge of surface water to watercourses and remove pollutants by providing water storage to allow sufficient time for solids to settle out.

6.4.33 The proposed carriageway drainage system will accommodate a 100% AEP (Annual Exceedance Probability) (1-year) rainfall event, without surcharging. The design will also ensure the 20% AEP (5-year) rainfall event will not exceed the drainage system chamber cover and flood the carriageway. In accordance with the Guidance for Planning Authorities on Strategic Flood Risk (SEPA, 2023), a 39% allowance for the effects of climate change has also been incorporated into the carriageway drainage design.

6.4.34 Side road drainage encapsulated into the mainline drainage catchments will be treated by two levels of SuDS treatment at the following locations:

- B867/Perth Road realignment in mainline drainage catchment B2;

- A822 (arm of roundabout) and Unclassified Road to Inver (arm of roundabout) in mainline drainage catchment D; and
- Dalguise Junction B898 in mainline drainage catchment H.

6.4.35 Where side roads cannot be incorporated into mainline drainage, the proposed side road drainage will incorporate a single level of SuDS treatment, which will generally comprise filter drains designed to allow for infiltration. There are some sections where conditions (topography and verge width within the earthworks) will also allow the adoption of swales instead of filter drains. The side roads will outfall to minor watercourses that are crossed by the scheme.

6.4.36 Pre-earthworks drainage consisting of shallow filter drains or lined ditches will be used to collect run-off from adjacent land and field drains. The proposed pre-earthworks drainage system will accommodate a 1.3% AEP (75-year) rainfall event. A 39% allowance for the effects of climate change has also been incorporated into the pre-earthworks drainage design.

6.4.37 All run-off from the proposed scheme will be collected and treated via the proposed drainage system prior to discharge. For new outfalls, SuDS are designed to treat and attenuate the peak flow from the new highway drainage system during a 0.5% AEP (200-year) rainfall event, plus a 39% allowance for the effects of climate change.

Watercourse Crossings

6.4.38 Wherever possible, watercourses will be maintained along their existing line. There are 16 existing watercourses that pass underneath the existing A9 carriageway, and these crossings will generally be extended or replaced in their current location.

- WF01: Existing 1.8m diameter culvert to be extended upstream.
- WF02: Existing 0.72m diameter culvert to be unchanged.
- WF05: Existing 0.6m diameter culvert to be extended upstream.
- WF05A: Existing 1.0m culvert to be extended upstream and downstream
- WF06 (River Tay): River Tay Crossing (Jubilee Bridge) to be retained and River Tay Bridge to be constructed.
- WF07: Replacement of existing culvert with a 1.8m diameter culvert and creation of open channel section.
- WF08 (Inchewan Burn): Replacement of existing bridge with the Birnam Glen and Inchewan Burn Bridge.
- WF09: Proposed 1.8m diameter culvert and existing 0.6m diameter culvert to be retained and extended upstream. Provision of a box culvert (1.5m x 1.0m) to act as a flood relief culvert.
- WF11 (River Braan): Replacement of existing bridge with River Braan Bridge.
- WF12 (Mill Lade): Existing box culvert (2.0m x 3.5m) unchanged.
- WF12A: Existing 1.05m diameter culvert unchanged.

- WF12B: Existing 1.2m diameter culvert to be replaced with realigned 1.8m diameter culvert and extended upstream.
- WF13: Replacement of existing 1.0m diameter culvert with realigned and extended (upstream and downstream) box culvert (1.8m x 2.7m).
- WF14: Upstream extension of existing 1.2m diameter culvert.
- WF16: Replacement and extension (upstream and downstream) of existing 1.1m diameter culvert with 1.2m diameter culvert.
- WF18: Replacement of existing 0.77m diameter culvert with box culvert (1.5m x 1.8m).

6.4.39 The detailed design of these watercourse crossing structures will be developed by the appointed Contractor, subject to suitable provision being made for flood flows and ecological and geomorphological mitigation, and compliance with the environmental commitments detailed within this EIAR. Additional information is provided in Chapter 19 (Road Drainage and the Water Environment), Appendix A19.3 (Watercourse Crossing Report) and Chapter 12 (Biodiversity).

**Flood Relief Culverts and Compensatory Flood Storage Areas**

6.4.40 The proposed scheme includes 14 flood relief culverts north of the River Braan crossing (refer to Appendix A6.1 Annex A and Appendix A19.2 (Flood Risk Assessment) for further details). These are likely be precast 3.6m x 1.2m box sections spaced 5m apart founded on structural fill and then backfilled at an invert level of 52.1mAOD. The end sections of the culverts will be precast structures providing a suitable finish and appearance which will be exposed. The construction of these culverts will be offline as a temporary diversion route will have been established to bypass the construction of the River Braan crossing. A further three flood relief culverts are included at Inver which convey additional floodwater within the Inver floodplain through the A9 carriageway into the River Tay. These are likely to be 1.5m diameter culverts.

6.4.41 One Compensatory Flood Storage Area is also required at ch4400 to ch4700 to mitigate for the loss of floodplain required to accommodate the proposed scheme (refer to Appendix A6.1 Annex A and Appendix A19.2 (Flood Risk Assessment) for design details).

**Traffic Signs and Lighting**

<u>Traffic Signs</u>

6.4.42 Traffic signs required for the proposed scheme will be prepared to the relevant design standards. The land-take for the proposed scheme allows for traffic signage where this is required, such as for the three main junctions at Birnam Junction, Dunkeld Junction and Dalguise Junction and for other accesses such as the three left-in left-out junctions on the main alignment, including for the Hermitage. The detailed design of this element of the works will be the responsibility of the appointed Contractor(s), and subject to compliance with the contract documents. As part of the design process, the Contractor will consult Transport Scotland and the local roads authorities.

Lighting

6.4.43 A lighting appraisal was carried out as part of the DMRB Stage 3 engineering assessment to assess the need and economic value of providing road lighting on the A9 mainline from Pass of Birnam to Tay Crossing. The existing route is currently not lit, and generally from an environmental perspective it is preferable to avoid road lighting in rural areas, as lighting can increase visual intrusion at night.

6.4.44 The DMRB Stage 3 appraisal concluded that it is not necessary to provide lighting along the whole route. For safety reasons and to achieve compliance with DMRB CD116 'Geometric Design of Roundabouts' (National Highways *et al.,* 2023) it is required that lighting is provided at the Dunkeld Junction. Lighting is also proposed at the Dunkeld & Birnam Station replacement car park. The lighting design seeks to reduce lighting impacts and effects on key receptors such as residential properties and ecological receptors (e.g. bats) at these locations.

6.4.45 Temporary lighting may be required across the proposed scheme where night-time and/or winter morning/afternoon working is necessary, to minimise traffic disruption/diversions/lane closures, and also along temporary access roads or other locations where temporary traffic management measures require lighting for safety reasons. Temporary lighting may also be required for security and safety reasons at site compounds during morning and evening working hours in winter.

6.4.46 The Contractor will determine the location of the main site compounds and seek all necessary approvals for their design and construction. Due to the length of the proposed scheme and proposed structures to be constructed, other smaller satellite offices, welfare facilities and compounds are likely to be established along the route.

## 6.5 Construction Methods and Programme

6.5.1 This section provides a brief overview of the envisaged construction programme and typical construction activities. Typical construction methods for these activities and the construction assumptions made for the purposes of this EIAR are provided in Appendix A6.1 (Construction Information). This section sets out a possible construction sequence for the proposed scheme, however, the design and construction process adopted by the appointed Contractor may vary from that described in this outline methodology. The appointed Contractor would be permitted to change the construction process and duration of each works element provided that environmental impacts are no greater than those described in this EIAR, and that commitments given in this EIAR are adhered to (or measures providing equivalent mitigation, subject to agreement with Transport Scotland).

6.5.2 Appendix A6.2 (Environmental Management Plan (Design Stage)) details the document (or set of documents) that sets out the mitigation needed to manage environmental effects associated with a development during the construction and operational phases. It provides a framework to manage the environmental effects of projects to demonstrate compliance with environmental legislation, by providing a plan for the delivery of the project's design, mitigation, enhancement and monitoring commitments. The plan, along with Chapter 22 (Schedule of Environmental Commitments), detail the management plans (such as a traffic management plan) that are required for the proposed scheme and committed to through mitigation.

6.5.3 The A9 Dualling Delivery Plan anticipates that, subject to completion of statutory processes, procurement is planned to commence in summer 2027, with contract award in Autumn 2028 and dualling expected to be operational by the end of 2032.

**Outline Construction Programme**

6.5.4 To assist the EIA process, the duration of the main works construction activities was estimated as being 3-4 years with a construction phase start date of Winter 2028/2029 and the proposed scheme operational by the end of 2032.

6.5.5 The indicative construction programme assumes the works will be split into three sections, anticipated to run generally concurrently. Within each section the works will be phased to reduce the impact on road users and neighbouring communities. The anticipated phase and section durations are detailed as follows:

- Advanced Works of up to 24 months on-site.
- Construction Works of 37 months of which:
  - site establishment and enabling works; and
  - southern section construction works of 35 months between Murthly and Dunkeld & Birnam Station (ch576 to ch3200);
  - central section construction of 30 months between Dunkeld & Birnam Station and Inver Rail Bridge (ch3200 to ch5700) and including works associated with Dunkeld & Birnam Station (replacement car park and pedestrian underpass) with section split into two sub-sections – Dunkeld & Birnam Station area (ch3200 to ch3500) and Dunkeld Roundabout and River Braan area (ch3500 to ch5700); and
  - northern section construction works of 30 months between Inver Rail Bridge and north of the Tay Crossing (ch5700 to ch8421).

6.5.6 Anticipated 'typical' working hours of the contractor will be agreed with Transport Scotland and the PKC Environmental Health Officer (EHO), but for the purposes of assessment, they are assumed as follows:

- 07:30 to 18:00 on weekdays (Monday to Friday);
- 08:00 to 13:00 on Saturdays; and
- no Sunday working.

6.5.7 Further details on working hours are detailed in Appendix A6.1 (Construction Information).

**Typical Construction Activities**

6.5.8 The key elements of the construction works have been broken down to facilitate the assessment of potential environmental impacts. The construction activities associated with the proposed scheme are outlined in Table 6.8.

**Table 6.8: Typical Construction Activities**

| Section | Construction Activities |
|---|---|
| Advance Works | ▪ Environmental mitigation to be implemented in advance of the main construction contract such as provision of bat boxes in retained woodland, management retained habitat for reptiles and planting of compensatory woodland (where practicable).<br>▪ Advance utilities diversions, such as for electricity, water and telecommunications.<br>▪ Building demolitions such as at Birnam Industrial Estate, Foster Contracting (North) Ltd and Auchlou.<br>▪ Archaeological investigations and excavations.<br>▪ Site clearance (vegetation, fencing etc.). |
| Roadworks | ▪ Site establishment and compounds for plant storage at strategic locations.<br>▪ Temporary and permanent fencing.<br>▪ Site clearance and demolition.<br>▪ Temporary and permanent surface water outfalls.<br>▪ Service diversions.<br>▪ Topsoil stripping and storage.<br>▪ Pre-earthworks drainage.<br>▪ Earthworks (cuttings and embankments).<br>▪ Environmental bunds and landscaping.<br>▪ Drainage, service ducts and chambers.<br>▪ Topsoil spreading, seeding and turfing.<br>▪ Pavement construction.<br>▪ Roadwork finishes including safety barriers, signs (including ITS and VMS), lighting and road markings.<br>▪ Accommodation works. |
| Structures | ▪ Bridge construction.<br>▪ Bridge demolition.<br>▪ Culvert construction.<br>▪ Retaining wall construction. |
| Environmental | ▪ Earthworks mitigation.<br>▪ Landscape and ecological mitigation planting. |

| Section | Construction Activities |
|---|---|
| Temporary Works | ▪ Temporary works to facilitate construction of structures.<br>▪ Temporary works to maintain pedestrian access to and parking for Dunkeld & Birnam Station<br>▪ Temporary carriageway to maintain traffic flows where roads are narrow or are affected by construction of the proposed scheme.<br>▪ Narrow lanes, contraflows or lane/road closures.<br>▪ River or stream diversions to facilitate culvert construction.<br>▪ Temporary SuDS at drainage outfalls. |
| Maintenance | ▪ Landscaping maintenance.<br>▪ Pavement rehabilitation and other routine maintenance and defects repair works. |

Construction Compounds

6.5.9 The location of construction compounds is unknown at this stage, as these will be determined by the appointed Contractor depending on the phasing and execution of the works. However, where possible these would be located close to the proposed works where there is suitable access.

6.5.10 The proposed scheme is to be progressed under the Roads (Scotland) Act 1984. The appointed Contractor may wish to acquire additional land for construction compounds outside the land identified on the Compulsory Purchase Orders (CPOs). In this case, separate permissions for the construction compounds may be required. This would also apply to any other land that may be required beyond the CPO for related activities such as of temporary access routes/haul roads.

6.5.11 The construction compounds would provide workplace/welfare facilities (e.g. toilets, staff areas) and parking for office-based staff and site operatives. In addition, material laydown and workshop areas (located within or near the compounds) would be provided for the construction phase.

Environmental Mitigation

6.5.12 The appointed Contractor will be required to implement all relevant environmental mitigation measures at the earliest appropriate time. These will include a range of measures to avoid or reduce construction and operational impacts.

6.5.13 Where practicable, physical environmental mitigation features, such as profiling of earthworks to reduce landscape and visual impacts and effects, would be constructed soon after the completion of the main engineering elements (further details on landscape and visual mitigation are provided in Chapter 10 (Landscape) and Chapter 11 (Visual)). Earthworks side slopes and verges would be topsoiled and seeded/planted early to minimise the risk of sediment-laden runoff, which may affect the carriageway drainage system and create a potential pollution risk to watercourses. Planting works and ecological habitat creation areas are seasonally dependent, and these will be appropriately programmed during the construction period to ensure suitable and optimum timing for their implementation.

## 6.6 Land Requirements

**Boundaries of the Site**

6.6.1 Most construction work will take place within the limit of the Boundaries of the Site (BotS) available to the appointed Contractor as defined within the contract documents. An indicative BotS is shown on Figure 6.2, which has informed the habitat and woodland loss calculations undertaken for assessment purposes in this EIAR.

6.6.2 The BotS would include land acquired under CPO and land to which the Scottish Ministers already has ownership of or access to.

6.6.3 The land to be acquired for the proposed scheme includes land necessary to construct the proposed scheme and associated infrastructure and to undertake essential environmental mitigation measures.

6.6.4 The appointed Contractor may wish to utilise other areas of land not covered by the BotS. In such an instance, the appointed Contractor would have to secure the use of these areas by agreement with the landowner and through separate planning applications, where appropriate. As the requirement and potential location of such areas is currently unknown, it has not been possible to include an assessment of the effects of them within this EIAR.

**Loss of Designated Areas**

River Tay SAC

6.6.5 Following design refinement to avoid the River Tay SAC where possible, the DMRB Stage 3 design requires approximately 0.47ha of permanent loss and 0.86ha of temporary loss of terrestrial and aquatic habitats of the River Tay SAC. The majority of this would be required to facilitate construction of the proposed scheme and would be returned to its former habitat type post-construction.

6.6.6 Details of the proposed temporary and permanent works proposed within the River Tay SAC are provided in Table 6.9.

**Table 6.9: Proposed temporary and permanent works within the River Tay SAC**

| Items of Infrastructure | Details | Chainage |
|---|---|---|
| Outfalls | Outfalls A, B2, D, G, H and I will be sited within the terrestrial habitat of the River Tay SAC. | ch800 (A)<br>ch2650 (B2)<br>ch4330 (D)<br>ch5650 (G)<br>ch7110 (H)<br>ch7800 (I) |
| Pre-earthworks drainage (PEDs) | Two PEDs will encroach within the terrestrial zone of the SAC. | ch2450<br>ch5900 |
| Access Tracks | Access tracks at the River Braan Bridge, west of Mill Stream, and north of the River Braan, west of Inver, will encroach within the terrestrial zone of the SAC. | ch4340 – ch4700<br>ch5050<br>ch5110 |
| Mainline | The mainline extends into the terrestrial habitat of the River Tay SAC. | ch4700 – ch4970 |
| Inver Mill Lade Culvert | The headwall and extension of the culvert 2m downstream will encroach into the River Tay SAC. | ch4940 |
| River Braan Bridge | The existing eastern abutment is situated within the River Tay SAC. A new sheet pile wall will be required to encircle the abutment and extend into the river bank in order to demolish the eastern abutment.<br>Pumping to keep the works area dry will likely be required, which may require the use of settlement tanks to allow discharge back into the river. | ch4300 – ch4350 |
| River Tay Bridge | The pier construction will be in close proximity to the River Tay SAC. A cofferdam will likely be required to construct the pier, to prevent water ingress during foundation construction. | ch7400 – ch7700 |

Ancient Woodland

6.6.7 Following design refinement to avoid or reduce loss of woodland from areas included in the SNH Ancient Woodland Inventory (AWI), the DMRB Stage 3 design results in approximately 29.02ha of AWI loss. However, the proposed scheme includes approximately 34.58ha of compensatory planting as shown on Figure 12.5 and reported in Table A12.6-3 of Appendix A12.6 (Woodland Strategy) and in Chapter 12 (Biodiversity).

6.6.8 The planting proposed is distributed throughout the proposed scheme in areas of variable size. The areas have been selected to maximise the biodiversity benefit of planting; maintain connectivity of existing AWI sites; and maximise opportunities to maintain functionality of local ancient woodland communities. It is also proposed that soil from high quality AWI sites will be re-used as appropriate to maintain fungal and invertebrate microbial biodiversity and provide a seed bank.

## 6.7 References

**National Legislation and EU Directives**

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