A9 DUALLING
PERTH TO INVERNESS
Tay Crossing to Ballinluig

A9 Dualling Programme: Tay Crossing to Ballinluig

Online v Offline Route Option Comparative Assessment

October 2016

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A9 Dualling Programme: Tay Crossing to Ballinluig

Transport Scotland

Online v Offline Route Option Comparative Assessment

B2140003/007

28th October 2016

TS/MTRIPS/SER/2013/03

Document history and status

Revision	Date	Description	By	Review	Approved
0	24/10/2016	Issued to Transport Scotland - Technical Note converted to A9 report format.	Paul Horan	Alan McGinley	Alan Gillies
1	28/10/2016	Issued to Transport Scotland -	Paul Horan	Keith Sheridan	Alan Gillies

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments
0	Alan McGinley	24/10/2016	Transport Scotland	Technical Note converted to A9 report format.
1	Alan Gillies	28/10/2016	Transport Scotland	TS Comments incorporated

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Project no:	B2140003
Document title:	Online v Offline Route Option Comparative Assessment
Document No.:	B2140003/007
Revision:	01
Date:	28th October 2016
Client name:	Transport Scotland
Client no:	TS/MTRIPS/SER/2013/03
Project manager:	Alan Gillies
Author:	Paul Horan
File name:	

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1. Introduction

The A9 Tay Crossing to Ballinluig Project comprises the upgrade of approximately 7.7km of single carriageway road to dual carriageway, commencing just north of the existing River Tay Crossing and terminating at the existing dualled section of the A9 on approach to the existing Ballinluig junction. The project is currently being progressed through Stage 2 of the Design Manual for Roads and Bridges (DMRB), where various alternative routes are considered, culminating in the identification of a preferred route.

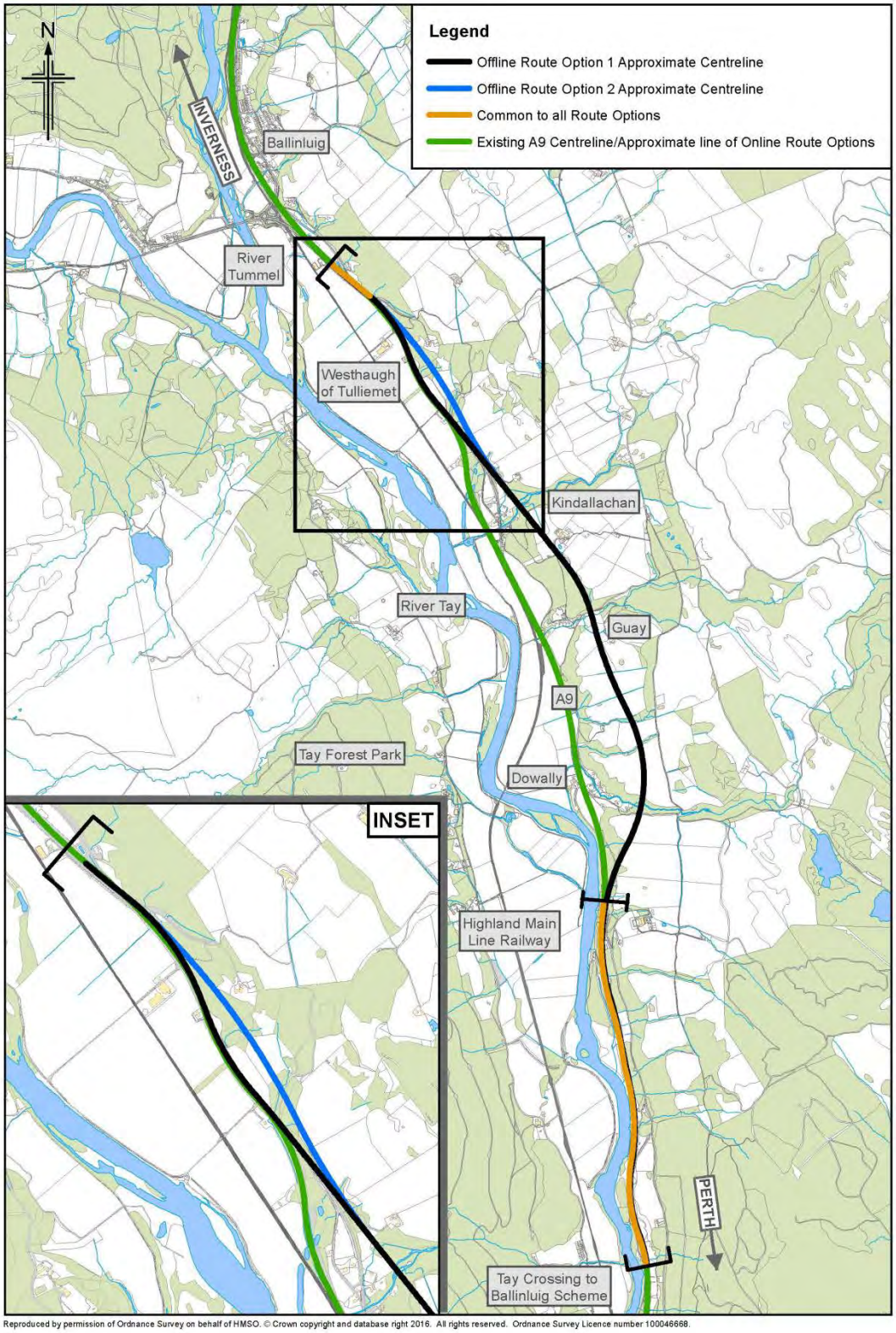
As part of this process, 4 mainline route options (with 4 associated side road options) were identified to be progressed and considered within the formal DMRB Stage 2 assessment process, each of these mainline route options are online options, i.e. they generally follow the alignment of the existing A9. These options were presented to the public at a public exhibition on the 9th/10th June 2015 and a community engagement event on the 9th/10th February 2016.

During ongoing consultation, members of the local community suggested the consideration of an alternative option with an alignment located to the east of the communities of Dowally, Guay and Kindallachan. In response to this, 2 additional options were developed which included a significant offline component to the east of the above referenced communities. Figure 1.1 overleaf provides a plan view of the overall A9 Tay Crossing to Ballinluig Project, and includes an outline of the approximate locations of the online and offline route options identified above.

This report presents a comparison of the original online route options presented to the public and those options with the offline component in the context of an engineering, environmental and traffic & economic assessment. The assessment is to a level appropriate to inform a comparison between the online and offline route options when considered in general terms, i.e. offline vs online as opposed to a comparison of each of the 6 individual options (4 online and 2 offline).

The offline and online route options share similar alignments at the northern and southern extents of the scheme with the central section moving to the east of the existing A9 for the offline route options, as reflected in Figure 1.1.

Figure 1.1: Online and Offline Route Options



2. Assessment Approach

The assessment presented in this report has been undertaken to compare the options under consideration and identify whether the offline options are more or less favourable than the online options for each of the assessment parameters identified in Table 2.1:

Table 2.1: Assessment Parameters

Criteria	Assessment Parameter
Engineering	Design Standard
	Local Road Network and Accesses
	Non-Motorised Users
	Geotechnics and Earthworks
	Hydrology and Drainage
	Structures
	Public Utilities
	Constructability
Environment	Community and Private Assets
	Geology, Soils, Contaminated land and Groundwater
	Road Drainage and the Water Environment
	Ecology and Nature Conservation
	Landscape and Visual
	Cultural Heritage
	Air Quality
	Noise and Vibration
	Effects on All travellers
	Materials
	Policies and Plans
Traffic and Economics	Cost

This comparative assessment provides details on the online and offline route options with the focus on those aspects of the online or offline route options which differ when considered under each of the assessment parameters identified above. For the purposes of clarity, the online and offline route options are titled per Table 2.2, with each of the route options presented in drawings B2140003/SK/124 -126 in Appendix A.

Table 2.2: Route Options

Online Route Option Title	Offline Route Option Title
Route Option 1	Offline Route Option 1
Route Option 2	Offline Route Option 2
Route Option 3	
Route Option 4	

3. Assessment

Details on the engineering, environmental and traffic & economic assessment are provided within this section of the report. A summary of the comparative assessment for all assessment parameters can also be found in the Assessment Matrix included in Appendix B.

3.1 Engineering

3.1.1 Design Standard

Online Route Options

The online route options predominantly follow the existing A9 alignment and have a similar number of relaxations from standard, 21 or 22 subject to the particular online route option. These relaxations are primarily associated with Stopping Sight Distance (SSD) and Horizontal alignment, which have been included to reduce the impacts on the landscape surrounding the proposed carriageway while adhering to current design standards. There is one departure from standard proposed for each of the online route options on the approach to a proposed left-in, left-out junction at Haugh of Kilmorich (refer drawing B2140003/SK/125 in Appendix A) associated with SSD.

The one departure from standards and various relaxations associated with the online route options are not significant and will not render the options unsafe.

Offline Route Options

Offline Route Option 1 has five relaxations whilst Offline Route Option 2 has six relaxations. These relaxations are primarily associated with SSD and horizontal alignment, which have been included to reduce the impacts on the landscape surrounding the proposed carriageway while adhering to current design standards. Neither of the offline route options requires a departure from standard.

The relaxations associated within the offline route options are not significant and will not render the options unsafe.

Both the offline and online route options propose a similar junction between the A9 and the Dunkeld to Rotmell (C502) road. There are 14 departures from standard in relation to the design of this junction, primarily associated with combinations of relaxations in horizontal alignment, vertical alignment and SSD achieved on the realigned local road on approach to the proposed junction. Preliminary discussions have been held with Perth & Kinross Council and no concerns have been raised in relation to the junction design. Further consultations on specific Departure from Standards and relaxations will be required throughout future design development.

Comparison

Both the online and offline route options are considered robust and safe in the context of their engineering design. Therefore from a Design Standard perspective, the online and offline options are considered generally comparable.

3.1.2 Local Road Network and Accesses

Online Route Options

Four side road options (titled Side Road Options 1 to 4) were presented to the public at the Community Engagement Events in February 2016. Side Road Options 1 and 2 provide a connection to both the northbound and southbound carriageway of the A9 minimising diversion times for local residents. Side Road Options 3 and 4 provide access to either the northbound carriageway or

southbound carriageway and result in a diversion of up to 9 minutes by utilising the proposed grade separated junction at Dalguise and existing grade separated junction at Ballinluig. All side road options maintain access to the key communities within the Tay Crossing to Ballinluig scheme.

A number of Departures from Standard are associated with the proposed left-in, left-out junctions within the side road options. Design refinement to improve the standard of junctions would be undertaken during future design development.

Offline Route Options

Each offline route option has one accompanying side road option. Both these options utilise the existing A9 within the sections of offline construction as part of the local road network. The primary difference between the two options is the location where the offline sections reconnect with the existing A9.

Offline Route Option 1 requires the construction of an additional section of side road to maintain access to the Haugh of Kilmorich, Haugh Cottages, Westhaugh of Tulliemet and Inch Farm. Additional land take is required for the construction of the new side road.

The access provisions for both offline route options will provide access to only the northbound carriageway and result in a diversion of up to 9 minutes utilising the grade separated junctions at Dalguise and Ballinluig. All side road options maintain access to the key communities within the Tay Crossing to Ballinluig scheme.

A number of Departures from Standard are associated with the proposed left-in, left-out junctions within the side road options. Design refinement to improve the standard of junctions would be undertaken during future design development.

Comparison

Both the online and offline route options include side road options which result in diversion times of up to 9 minutes, albeit there are side road options available to the online option which reduces diversion times. However for the purposes of this comparison in the context of the local road network and accesses between online and offline route options, it is considered that both options are generally comparable.

3.1.3 Non-Motorised Users

Online Route Options

The online route options require the potential realignment of Regional Cycle Route 83 and a Core Path, however their functionality will not be affected. Side Road Options 1 and 2 (associated with the online options) provide connectivity to the bus stop on the northbound carriageway at Kindallachan, via the overbridge included with these options. An alternative connection to the bus stop would be considered during any future design development for Side Road Options 3 and 4. Between Dowally and Guay, Side Road Options 1 and 3 will require realignment of an existing NMU route while Side Road Options 2 and 4 will provide an alternative connection through the designs associated with these side road options. None of these realignments will affect the routes functionality.

Offline Route Options

The offline route options also require the potential realignment of Regional Cycle Route 83 and 2 Core Paths, but potentially require grade separated crossings in order to maintain existing NMU provision. Offline Route Option 2 would also sever a local path at approximately Ch. 7200; potentially requiring an additional grade separated crossing or diversion of the route in order to maintain connectivity.

NMU access to the existing bus stops at Kindallachan will be maintained. Access to the bus stops from the northbound carriageway is straightforward due to the junction configuration. However, access from the southbound carriageway of the offline route options would have to be considered during future design work. Consultation with Perth & Kinross Council and the Bus Operating Companies will be required to confirm bus service provisions.

Comparison

Although alternative NMU routes have yet to be designed for either the online or offline route options, the likely need to construct grade separated crossings for the offline route options result in the offline route options being less favourable than the online route options.

3.1.4 Geotechnics and Earthworks

Online Route Options

There are significant earthworks associated with the online route options, creating a surplus of material of between 747,500m^3 and 880,500m^3. In addition to this, the online route options require between approximately 990m to 1140m of soiling nailing along the various route options.

There are areas at risk of landslide identified adjacent to the southbound carriageway at several locations along the online route options.

Offline Route Options

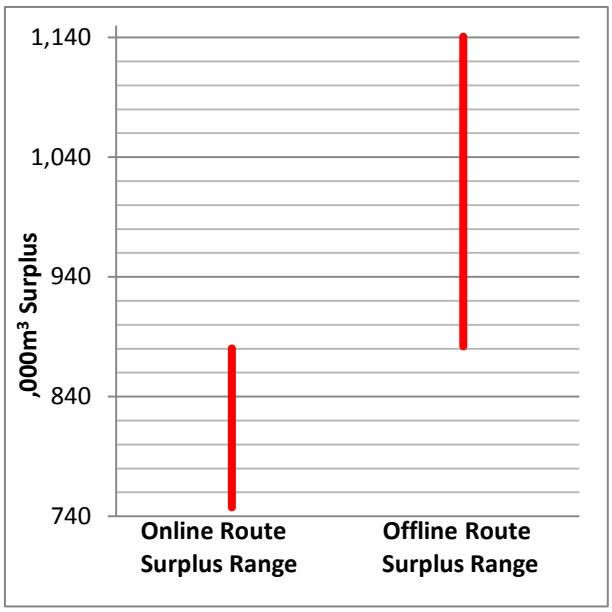
There are also significant earthworks associated with the offline route options, creating a surplus of material of between 882,000m^3 and 1,140,500m^3. In addition to this, the offline route options require between approximately 850m and 1130m of soiling nailing along the route options.

There are also areas at risk of landslide identified adjacent to the southbound carriageway at several locations along the route.

Comparison

The offline route options represent an increase in the volume of surplus material generated when compared with the online route options as highlighted in the ranges of surplus material for each route option, which are displayed graphically in Figure 3.1. The risk of landslides is similar for the online and offline route options, based on studies. It should be noted that these landslide risks are currently present in the existing situation due to the nature of the existing geomorphology and topography of the region. Overall, the online and offline route options are generally comparable with regards geotechnical and earthworks considerations.

Figure 3.1: Route Options Disposal Ranges



3.1.5 Hydrology and Drainage (see Road Drainage and Water Environment for details on flooding)

Online Route Options

The online route options have three named watercourse crossings, Dowally Burn, Sloggan Burn and Kindallachan Burn. New bridges or bridge extensions will be required for the named watercourse crossings. Other smaller watercourses will require culvert extensions.

A review has been undertaken to confirm that a drainage solution exists for each of the online options under consideration, with due consideration of constraints such as topography and flood risk, and which could meet the requirements to provide necessary quality improvement treatment prior to discharge to existing watercourses.

Offline Route Options

The offline route options also have three named watercourse crossings, Dowally Burn, Sloggan Burn and Kindallachan Burn. Significant new bridges will be required for the named watercourse crossings depending on specific location and other smaller watercourses will require culvert extensions or the inclusion of new culverts.

As per the online options, a review has been undertaken to confirm that a drainage solution exists for each of the online options under consideration, with due consideration of constraints such as topography and flood risk, and which could meet the requirements to provide necessary quality improvement treatment prior to discharge to existing watercourses.

Comparison

As both the online and offline route options cross the same number of watercourses, and it has been confirmed that a functioning drainage solution can be developed for all options, both the online and offline route options are considered generally comparable in the context of Hydrology and Drainage.

3.1.6 Structures

Online Route Options

The following main structural components are required as a result of the online options:

- Kindallachan Underbridge (Kindallachan Burn): Extension or replacement of an underbridge with overall length of 13.1m using single span; and
- Dowally Underbridge (Dowally Burn): Overall length 12m using single span.

Replacement and extensions of two large culverts common to all online route options as follows:

- Dowally Burn Culvert: 14.9m extension; and
- Sloggan Burn Culvert: 14.2m extension.

Significant retaining wall structures are required for all online route options having the following details:

- Online Route Options 1 and 2: 350m length wall with average height of 3.7m with maximum height of approximately 6.5m located to the north of Cuil-an-Duin; and
- Online Route Options 3 and 4: 350m length wall with average height of 2.1m with maximum height of approximately 5.5m located to the north of Cuil-an-Duin.

Side Road Options 1 and 2 will require a side road overbridge crossing the A9 with a clear span over the A9 of approximately 35.5m with no skew. The square width of the new deck will be approximately 8.5m.

Offline Route Options

The following main structural components are required as a result of the offline options:

Significant Structures are required in relation to the crossing of large watercourses, common to all offline options as follows:

- Dowally Underbridge (Dowally Burn): Overall length 66m using single span;
- Guay Underbridge (Dowally Burn): Overall length of 140m using 3 spans; and
- Kindallachan Viaduct (Kindallachan Burn): Overall length of 258m using 6 spans.

Significant Retaining Wall Structures are required for both offline options as follows:

- Offline Route Option 1 – 350m length wall with average height of 3.4, with maximum height of approximately 6.2m located to the north of Cuil-an-Duin; and
- Offline Route Option 2 – 550m length wall with average height of 8.4m, with maximum height of approximately 17.9m in the vicinity of Cuil-an-Duin.

Comparison

Both the online and offline options will require the construction of new and additional structures. However the offline route options include the requirement for three very significant structures and a larger retaining wall (Offline Route Option 2 only), this is considered less favourable than the online route options which do not require structures of this scale.

3.1.7 Public Utilities

Online Route Options

The online route options and side road options would result in six interfaces with Openreach Underground network, seven interfaces with Openreach Overhead network and four interfaces with Scottish Water, Water Supply Infrastructure. The online route options result in 19 to 20 interfaces with SSE Electricity Distribution Network.

The online route options have impacts on SSE Distribution Network, Scottish Water: Water Supply Infrastructure and Openreach telecommunications network. It is not anticipated that any of the impacts present a particular problem for the development of the online route options.

Offline Route Options

The offline route options would result in two to three interfaces with Openreach Underground, four interfaces with the Openreach Overhead network and one interface with Scottish Water, Water Supply Infrastructure. Both offline route options would result in eight interfaces with SSE Electricity Distribution Network.

The offline route options have impacts on SSE Distribution Network, Scottish Water: Water Supply Infrastructure and Openreach telecommunications network. It is not anticipated that any of the impacts present a particular problem for the development of the offline route options.

The offline route options also pass in close proximity to two existing private hydrological electricity generation schemes in Dowally and Kindallachan. Although the offline route options do not directly impact these schemes, there is a potential conflict with the associated pipe network at both locations.

Comparison

The online route options have a greater impact on public utilities with up to 37 identified interfaces. The offline route options have 16 identified interfaces with public utilities and two potential interfaces with private utilities (Dowally and Kindallachan Hydro Schemes) which will result in a significant decrease in the scale of diversionary work required. The online route options are therefore less favourable than the offline route options in the context of Public Utilities.

3.1.8 Constructability

Online Route Options

Online construction generally involves using the existing single carriageway to convey operational traffic whilst constructing a central reserve and second carriageway parallel to it on either the northbound of southbound side of the carriageway. Constructability issues could arise as the alignment transitions from southbound to northbound widening as one lane of traffic in each direction is required at all times where practicable and potentially represents an issue with regards traffic management. In terms of carriageway cross overs, the need for cross overs varies from zero to four subject to the specific online route option. Each cross over will require additional traffic management and signage but they are not considered to present a particular problem to a competent contractor, albeit fewer cross overs reduce the traffic management requirements.

Much of the existing ground alongside the route of the online route options comprises steep topography generally falling from east to west along the route. This results in significant cuttings in the sections of the mainline route options which comprise southbound widening.

Construction of the online route options in close proximity to properties may be impacted by the necessity for reduced working widths and the requirement to maintain access during construction but this is not considered a significant constraint.

Several areas to the east of the existing A9 form part of the 1 in 200 year flood plain of the River Tay. The mainline route options and side road options have an impact on the River Tay flood plain potentially impacting construction works during and after extreme storm events.

Offline Route Options

The offline route options consist of online southbound widening to the south of the Dunkeld to Rotmell (C502) road junction before heading offline and connecting online to the north of Kindallachan.

Constructability issues could arise as the alignment begins to transition offline as one lane of traffic in each direction is required at all times where practicable and potentially represents an issue with regards traffic management. The vertical alignment of the offline route options changes within the extents of the online section between Ch. 2700 and Ch. 3150 approximately in order to reduce earthworks associated with the offline route options. This increase in level represents a constructability issue as it will result in the need to incorporate some form of retaining structures during the construction to reduce impacts on the existing carriageway.

The existing ground along the route of the offline route options comprises steep topography generally falling from east to west along the route. This results in significant cuttings to the east and embankments to the west of the routes. This is more significant in Offline Route Option 2 as the route option continues in an offline construction for a greater distance than Offline Route Option 1.

The offline route options result in three significant bridge structures, all of which are likely to require the construction of temporary bridges to facilitate their construction. Offline Route Option 2 includes a significant length of retaining wall, the height of which is considered to be at the upper bounds of practical construction.

Several areas to the east of the existing A9 form part of the 1 in 200 year flood plain of the River Tay. Offline Route Option 1 re-joins the existing A9 north of Kindallachan and impacts on a small section of the River Tay 1 in 200 year flood plain potentially impacting construction works during and after extreme storm events. As Offline Route Option 2 does not join the existing A9 until further north, just south of Ballinluig, the route option has a limited impact on the River Tay 1 in 200 year flood plain.

Comparison

Offline construction is generally more favourable than online construction due to the reduced need to operate traffic management during the construction process. However, due to the difficulties associated with the construction of the structures on the offline route options and the extensive earthworks that are required, an online solution is deemed more favourable in this instance despite the increased traffic management requirements associated with online widening.

Widening into the hillside and into the flood plain will require careful consideration. Although the online route options runs alongside a longer section of floodplain when compared to the offline route options, it is considered that the impact of construction within the River Tay 1 in 200 year flood plain is generally comparable as both the online and offline options will still require careful consideration.

3.2 Environment

3.2.1 Community and Private Assets

Online Route Options

The online route options are expected to have no impacts on community land or development land. Land-take of between 1.2ha and 1.6ha is expected to affect (directly or due to changes in access) up to 16 residential properties and a further two commercial/industrial properties (House of Bruar Warehouses and Network Rail).

All of the online route options would result in land-take of less than 0.1ha from St. Anne's Church Car Park in Dowally. Residents of Kindallachan may have access to the northbound bus stop severed under two of the options, although alternative NMU provisions will be considered during future design development.

All online route options would result in the demolition of an agricultural shed at Guay Farm. Three agricultural, forestry and sporting land interests would be affected by all online route options, of which two have a greater land-take at Atholl Estate and Dowally, Guay and Haugh of Tulliemet Farms. Land-take from agriculture and forestry varies between approximately 23.7ha and 29.7ha depending on the route option and side road combination. Land-take is generally from the edge of the forestry compartments and equates to approximately 25% of the total land-take.

Mitigation would be implemented to reduce construction impacts and address potential access impacts. However, permanent impacts on residential and commercial properties (predominantly land-take) and agricultural, forestry and sporting interests (predominantly land-take) are expected to remain.

Offline Route Options

The offline route options are also expected to have no impacts on community land or development land.

Offline Route Option 1 will result in land-take of approximately 1.5ha from seven residential properties and two commercial/industrial properties (House of Bruar Warehouses and Cuil-an-Duin), with the majority of the land-take in the offline section.

Offline Route Option 2 would affect three residential properties, four fewer than Offline Route Option 1, and the same two commercial/industrial properties (House of Bruar Warehouses and Cuil-an-Duin). However land-take from the remaining properties would increase to approximately 3.0ha with particular impact on Cuil-an-Duin (a country house B&B assessed as a commercial property) with land-take equating to 30% of the property and arising from the main alignment and construction of a retaining wall of up to 17.9m.

Relief from existing community severance would be expected for both offline route options, particularly to St Anne's Church and the northbound bus stop as traffic flows on the A9 would be lower. However additional severance of properties to the east of the offline section will be introduced, although alternative provisions will be considered during future design development, which would also include access to the bus stops from the southbound carriageway of the offline route options.

Offline Route Option 1 has the greatest agricultural and forestry land-take of the two options; 44.7ha in total, which is 4.1ha more than Offline Route Option 2, primarily as a consequence of a greater land-take from the side road at Haugh of Tulliemet. Loss of forestry/woodland accounts for 31% of the land-take of Offline Route Option 1 and 37% for Offline Route Option 2. Both offline route options

would require demolition of market garden poly-tunnels at West Countlich (forming part of Alex Butter Market Garden and Landscaping) and an unoccupied cottage at Ballintuim.

Mitigation would be implemented to reduce construction impacts and address potential access impacts. However, permanent impacts on residential and commercial properties (predominantly land-take) and agricultural, forestry and sporting interests (predominantly land-take and severance of fields and forestry compartments) are expected to remain.

Comparison

The offline route options offer a relief from community severance (easier access to St Annes Church and northbound bus stop) and affect fewer residential and commercial properties than the online route options but land-take and access impacts would be greater than the online route options, particularly for Offline Route Option 2. Additionally, design development would be required to provide access to the southbound bus stops for the offline route options. The offline route options have a greater land take and agricultural land severance than the online route options and would also result in the demolition of poly-tunnels at West Countlich (Alex Butter Market Garden and Landscaping) and an unoccupied farm cottage at Ballintuim. Therefore the offline route options are less favourable than the online route options in terms of community and private assets.

3.2.2 Geology, Soils, Contaminated Land and Groundwater

Online Route Options

There are potentially significant residual impacts on groundwater flow and groundwater linked surface water and ecological receptors associated with all online route options.

The online route options would require widening of existing cuttings and construction of new cuttings at nine sites, ranging in excavation depth from 2m to 22m. Eight of the cuttings are likely to intercept groundwater and potentially have a significant impact on groundwater linked with surface water and ecological receptors.

Five contaminated land sites are anticipated to be directly impacted by the online route options, with a further seven anticipated to be indirectly affected (where cuttings may intercept groundwater and may draw contaminated groundwater towards the cutting).

No specific mitigation measures are required for any potential geological impacts, but standard mitigation taking into account best practice, legislation and guidance in combination with ground investigation would be implemented to avoid or reduce potential impacts on contaminated land and groundwater.

Offline Route Options

These are also potentially significant residual impacts on groundwater flow and groundwater linked surface water and ecological receptors associated with all offline route options.

The offline route options will require 11 cuttings, ranging in excavation depth from 1.6m to 20.8m. Six cuttings are likely to intercept bedrock and ten of the cuttings would likely intercept groundwater and potentially have a significant impact on groundwater linked with surface water and ecological receptors.

Three contaminated land sites are anticipated to be directly impacted by Offline Route Option 1, with a further two anticipated to be indirectly affected (where cuttings may intercept groundwater and may draw contaminated groundwater towards the cutting). Direct impacts on contaminated land for Offline Option 2 are anticipated to be the same as for Offline Route Option 1 with the exception of one site

which would be directly impacted by Offline Route Option 2 rather than indirectly impacted as by Offline Route Option 1.

As per the online route options, no specific mitigation measures are required for any potental geological impacts, but standard mitigation taking into account best practice, legislation and guidance in combination with ground investigation would be implemented to avoid or reduce potential impacts on contaminated land and groundwater.

Comparison

The online and offline route options are expected to have similar impacts in terms of number of cuttings and cutting depths with a number of sites likely to intercept groundwater. Both online and offline route options have the potential to have direct and indirect impacts on potentially contaminated land sites. Therefore from a Geology, Soils and Contaminated Land and Groundwater perspective the online and offline options are generally comparable.

3.2.3 Road Drainage and the Water Environment

Online Route Options

The online route options require a minimum of one bridge, between 18 and 20 culverts and seven outfalls with 15 water features requiring in-channel works. All online options would encroach into the River Tay 1:200 year floodplain at three locations (mainline embankments, side roads, and left-in left-out junction).

The modelled scenario is a 1:200 year flood event (+20% climate change). The online route options would require the mainline alignment to be raised from its current level and if the A9 was not dualled and left at its current level, the A9 would be inundated with flood water during this event. In order to protect the dualled A9, the level of the road will be raised outwith the flood event. This will encroach further into the flood plain and mitigation for the additional floodplain loss will be included within the design.

Standard or good practice mitigation measures during construction and operation would be expected to mitigate impacts on hydrology, fluvial geomorphology and water quality. Mitigation for loss of floodplain has been discussed with SEPA, and would include measures such as side road design refinement or retaining walls (to reduce land loss) and the provision of compensatory storage areas, provision of flood relief culverts, and reconnection of isolated areas of floodplain to provide compensatory storage. These measures, when implemented, would be expected to reduce the impact of the loss of River Tay functional floodplain area for the online options and, with mitigation, would not be expected to increase flood risk.

Offline Route Options

The offline route options require three bridges, 26 culverts and seven outfalls with potential impact on 28 water features requiring in-channel works. The online section of Offline Route Option 1 would encroach into the River Tay in the 1:200 year functional floodplain at two locations (side road embankment and left-in left-out junction). However, Offline Route Option 2 would not encroach into the River Tay 1:200 year functional floodplain.

The modelled scenario is a 1:200 year flood event (+20% climate change). During this event, the existing A9 would flood at its current level and would be inundated with flood water during this event. Although the existing A9 will be used as a distributor road for Dowally, Guay and Kindallachan, the offline route options will not raise the level of the existing A9 and it will continue to flood during this storm event.

Standard or good practice mitigation measures during construction and operation would be expected to mitigate impacts on hydrology, fluvial geomorphology and water quality. Mitigation for loss of floodplain would include measures such as side road design refinement or retaining walls (to reduce land loss), the provision of compensatory storage areas, provision of flood relief culverts, and reconnection of isolated areas of floodplain to provide compensatory storage. These measures when employed would be expected to reduce the impact of the loss of River Tay functional floodplain area for Offline Route Option 1 and with mitigation would not be expected to increase flood risk.

Comparison

Although the online route options impact fewer water features, the offline route options have a reduced encroachment within the 1:200 year functional floodplain. Therefore the online route options are considered to be the least favourable in terms of water quality and fluvial geomorphology however mitigation measures can be implemented to reduce the impact on the loss of functional floodplain for both the online and offline route options.

3.2.4 Ecology and Nature Conservation

Online Route Options

The online route options will have potential impacts on ecological receptors including The online route options will have potential impacts on ecological receptors including permanent significant impacts on the River Tay SAC (international importance) and ancient woodland (national importance).

The online route options would result in a permanent loss of aquatic and terrestrial SAC (River Tay) habitat of international importance and approximately 8.43ha to 10.11ha of category 1a, 2a and 2b habitat listed on the Ancient Woodland Inventory (AWI) depending on the online route option and side road combination. Loss of woodland is generally from category 1a and 2b habitat at the edge of the woodland compartments.

Significant ecological impacts are expected to be mitigated through a combination of best practice and mitigation techniques targeted to specific locations. Potential habitat loss including for qualifying species of the River Tay SAC could be reduced or offset through enhancement of existing habitat with the aim of increasing the amount of supporting habitat available for qualifying species and/or compensated through:

- provision of new habitat in landscape design;
- translocation of soils and/or other features associated with ancient woodland;
- provision of alternative sites; and
- planting.

However, it should be noted that loss of ancient woodland cannot be compensated for its biodiversity importance due to its complex ecosystems.

Offline Route Options

The offline route options will have potential impacts on ecological receptors including permanent significant impacts on the River Tay SAC (international importance) and ancient woodland (national importance).

Offline Route Options 1 and 2 would both result in a permanent loss of aquatic and terrestrial SAC (River Tay) habitat and approximately 11.38ha and 13.75ha respectively of category 1a, 2a, 2b and 3 habitat listed on the AWI. The majority of the woodland loss arises from category 1a and 2a habitat in the offline sections of the route options, where the main alignment would also result in habitat fragmentation and severance; potentially creating a barrier to species movement and reducing habitat connectivity.

Potential habitat loss could be reduced or offset through enhancement of existing habitat with the aim of increasing the amount of supporting habitat available for qualifying species and/or compensated through:

- provision of new habitat in landscape design;
- translocation of soils and/or other features associated with ancient woodland;
- provision of alternative sites; and
- planting.

However, it should be noted that loss of ancient woodland cannot be compensated for its biodiversity importance due to its complex ecosystems.

Comparison

For both online and offline route options, the River Tay SAC and ancient woodland would be potentially permanently impacted. Overall, offline route options would have the potential to result in more impacts, with some being of a greater magnitude, than online options due to severance and fragmentation of habitats. The greater impacts associated with offline route options identify it as the least favourable option in terms of Ecology and Nature Conservation.

3.2.5 Landscape/Visual

Online Route Options

Online Route Options 1 to 4 would have limited impacts on the River Tay (Dunkeld) National Scenic Area (NSA) which would not be significant or affect its overall integrity. The Tay Valley subsidiary Landscape Character Area (LCA) within the wider Lower Highland Glens LCA, would be affected by adverse impacts upon its overall character and its key components and qualities.

All online options would skirt the edge of the flat valley floor, lying against a backdrop of the valley slopes, on an alignment that generally fits well with the natural landform, despite the need for cuttings into the lower hill slopes.

Potential adverse visual impacts from the online options are expected at some residential receptors in settlements at Dowally (mainly properties which currently have views to the A9, where the widening would be closer to them and some screening vegetation would be lost), Guay (some properties close to the widening and new side-road, which would remove existing screening provided by planting) and Kindallachan (properties closest to the existing A9, where screening vegetation would be removed).

Other residential properties on the west side of the Tay Valley at Inchmagrannachan and Dalmarnock Farm would gain views of the revised cuttings associated with the online options. Views from properties along General Wade's Military Road and Rotmell would be affected due to loss of screening woodland associated with the online widening.

Residents at Haugh of Kilmorich, Haugh Cottages and Westhaugh of Tulliemet, all of which lie in close proximity to the A9 and currently gain views to it would have clear, close range views of the online widening and new side roads, the latter two properties also affected by views of the new retaining wall on the east side of the carriageway.

The online Route Options would be visible through open or filtered views by road users (B898 and General Wades Military Road), rail users (Highland Main Line Railway), and cyclists on designated routes (NCR 77 and RCR 83).

Mitigation during construction would involve best construction practice. Opportunities for landscape and visual mitigation measures during operation would include retention of trees and vegetation

where possible, new planting and boundary treatments, sensitive grading of earthworks, and shaping and planting of SuDS basins to improve integration with the surrounding landform.

Mitigation would be expected to provide a reduction in adverse landscape and visual impacts, in particular woodland planting helping to visually integrate cuttings slopes with the surrounding hillside over time and provide screening for residential properties.

Offline Route Options

Offline Route Option 1 would have limited impacts on the River Tay (Dunkeld) NSA which would not be significant or affect its overall integrity. The Tay Valley subsidiary LCA within the wider Lower Highland Glens LCA, would be affected by adverse impacts upon its overall character and its key components and qualities.

Landscape impacts for Offline Route Option 2 would be broadly similar to Offline Route Option 1 for the majority of the route (up to Ch. 6500). However, as Offline Route Option 2 remains offline and includes a retaining wall of up to 17.9m in height between Ch. 7350 and Ch. 8050, impacts on Tay Valley subsidiary LCA are greater for this offline route option.

Both offline options would increase the visual prominence of the A9 within the Tay Valley, with the road at a considerably higher elevation than the existing A9, which currently skirts the edge of the flat valley floor, lying against a backdrop of the valley slopes, on an alignment that fits well with the natural landform.

Potential adverse visual impacts from Offline Route Option 1 and its bridge structures are expected at some residential receptors in settlements at Dalguise (at those roadside locations where views can be obtained), Dowally (properties at the eastern edge), Guay (properties at the eastern edge), Kindallachan (most properties) and Logierait (properties on the eastern edge). Other residential properties at Inchmagrannachan, Dalmarnock Farm, properties along General Wade's Military Road, Rotmell and those properties at and near Haugh Cottages would also be expected to be adversely affected due to filtered or open views of the offline route carriageway and bridge structures.

Offline Route Option 1 would be in close proximity to several properties on the hill slopes between Dowally and Kindallachan. Open views of the carriageway and bridge structures would be expected to affect residents at Balnabeggan, Ballintuim, West Countlich, Middle Countlich, East Countlich and Croftnascallaig where currently these properties experience no visibility of the existing A9.

Offline Route Option 2 visual impacts for residential receptors at Dalguise, Dowally and Guay are expected to be the same as for Offline Route Option 1. At Kindallachan, the cuttings/embankments would be more visually intrusive than Offline Route Option 1, with the bridge structure likely to be visible from properties at the eastern edge of the settlement. Impacts from Offline Route Option 2 on other residential receptors where properties currently experience no visibility of the existing A9 would be the same as for Offline Route Option 1.

Residents at Haugh of Kilmorich and West Haugh of Tulliemet would have clear views of Offline Route Option 2 whilst residents at Haugh Cottages would have direct views screened by intervening woodland. The retaining wall of up to 17.9m between Ch. 7350 and Ch. 8050 is likely to be visible to all these properties.

Potential beneficial changes in views of the existing A9 would be expected for some properties within the western side of the settlements of Dowally, Guay and Kindallachan due to a reduction in the volume of traffic in views of the de-trunked section of the A9.

Offline Route Option 1 would be visible through open or filtered views by road users (B898 and General Wades Military Road), rail users (Highland Main Line Railway), and cyclists on designated routes (NCR 77 and RCR 83). Offline Route Option 1 would cut through several east-west connecting

paths and so walkers on designated routes would also have open and filtered views of the carriageway and bridge structures. Impacts of Offline Route Option 2 on road and rail users and cyclists and walkers would be the same as Offline Route Option 1 for the majority or the entire route.

Mitigation during construction would involve best construction practice. Opportunities for landscape and visual mitigation measures during operation of either Offline Route Option 1 or 2 would include retention of trees and vegetation where possible, new planting and boundary treatments, sensitive grading of earthworks, de-trunking of the existing A9 which would result in a traffic reduction, and shaping and planting of SuDS basins to improve integration with the surrounding landform.

Mitigation planting would help to reduce impacts to some extent over time with woodland helping to replace woodland lost due to construction and screening views of the road and traffic. Mitigation would be expected to provide limited reduction in the adverse landscape impacts of introducing the new offline section of the road into the rural landscape, and open and filtered views of the three bridge structures and offline main alignment would remain in the long term, including from properties currently with no visibility of the existing A9.

Comparison

The offline route options have substantially greater landscape and visual impacts than the online options due to the alignment deviating offline, away from the existing established transport corridor at the edge of the flat valley floor, to the relatively unspoiled and tranquil undulating higher ground of the valley slopes. This would result in the need for three large scale prominent structures and associated earthworks to negotiate the crossings of intimate small scale valleys at Dowally, Guay and Kindallachan and through areas of mature AWI woodland. The route would be prominent in the landscape, sitting at a higher elevation with sections on high embankment, whereas the online route options would all be relatively subdued, at the edge of the flat valley floor, sitting against a backdrop of the valley slopes and woodland. The offline route options would cause new visual impacts at a number of rural properties that are currently unaffected by views of the A9 and a number would gain views of the prominent elevated bridge structures with effective mitigation unlikely to be achieved, whereas the majority of receptors affected by the online route options currently gain views of the existing A9.

As the offline route options have a significant impact on landscape and visual, these are considered least favourable in terms of landscape and visual impacts.

3.2.6 Cultural Heritage

Online Route Options

All online options are predicted to potentially impact on Kindallachan Cairn and Kindallachan Standing Stone, both Scheduled Monuments. Mitigation in the first instance would be avoidance, but where this is not possible, in agreement with Historic Environment Scotland and subject to Scheduled Monument Consent, mitigation could be in the form of detailed excavation.

All the online route options have the potential to affect the setting of Guay Farmhouse (Category B Listed Building) and Westhaugh of Tulliemet Cross Slab (Scheduled Monument and Category B Listed Building). Given the proximity of these assets to the online route options, mitigation is not predicted to reduce this, and an impact on the setting of these assets is predicted during construction and operation.

Online route options would result in the partial removal of historic landscape elements, or changes in land use, for the following historic landscape types (HLT): 17th to 19th Century rectilinear Fields and Farms (HLT 1, low value); Managed Woodland (HLT 2, low value); 19th Century to Present Coniferous Plantation (HLT 3, negligible value); 19th Century to Present Urban Area (HLT 4, negligible value) and, Transport (HLT 15, negligible value). Construction impacts i.e. removal of

elements of, and changes to, land use of HLT1, HLT2, HLT3, HLT4 and HLT15 would continue into operation.

Potential mitigation to avoid or reduce impacts would include design development; recording works in advance of, or during construction; retention of landscape features, trees and vegetation; and mitigation planting.

Offline Route Options

The offline route options would remove remains associated with 12 known cultural heritage assets and would introduce temporary sources of noise and visual intrusion into the setting of seven cultural heritage assets during the construction period. There could be potential impacts on, as yet, unknown buried archaeological remains.

All the offline route options have the potential to impact the setting of Westhaugh of Tulliemet Cross Slab (Scheduled Monument and Category B Listed Building). Given the proximity of this asset to the route options mitigation is not predicted to reduce this impact during construction and operation.

Offline route options would result in the partial removal of historic landscape elements, or changes in land use, for the following historic landscape types: 17th to 19th Century rectilinear Fields and Farms (HLT 1, low value); Managed Woodland (HLT 2, low value) and, 19th Century to Present Coniferous Plantation (HLT 3, negligible value). Construction impacts i.e. changes to current land use of HLT1, HLT2 and HLT3 would continue into operation.

During operation, Offline Route Option 1 would affect the setting of Westhaugh of Tulliemet Cross Slab (Scheduled Monument and Category B Listed Building), Cuil-an-Duin Category B Listed Building, Westhaugh of Tulliemet Steading (Category B Listed Building), and Westhaugh of Tulliemet Farmhouse (Category C Listed Building).

Offline Route Option 2 would have a greater potential impact on the setting of Cuil-an-Duin Category B Listed Building than Offline Route Option 1 during both construction and operation, as it is closer to the asset and due to the proximity of the property to the retaining wall. Offline Option 2 would have less of an impact on the setting of Westhaugh of Tulliemet Cross Slab (Scheduled Monument and Category B Listed Building), Westhaugh of Tulliemet Farmhouse (Category C Listed Building), and Westhaugh of Tulliemet Steading (Category C Listed Building).

Potential mitigation to avoid or reduce impacts would include design development; recording works in advance of, or during construction; retention of landscape features, trees and vegetation; and mitigation planting.

Comparison

Both the online and offline route options would be expected to affect the setting of Westhaugh of Tulliemet Cross Slab (Scheduled Monument and Category B Listed Building). However, the online route options would result in the potential removal of Kindallachan Cairn and Kindallachan Standing Stone Scheduled Monument which are not affected by the offline route options. Therefore the online route options are considered the least favourable options in terms of cultural heritage.

3.2.7 Air Quality

Online Route Options

Sensitive receptors within 50m of the online route options would be those at greatest risk of nuisance associated with construction related dust. With the implementation of appropriate mitigation, impacts from construction activities are not likely to be significant across all route options.

A total of 69 sensitive receptors were identified within 200m of the online route options. With the implementation of appropriate mitigation, impacts from construction activities for any of the online options are unlikely to be significant. Local air quality effects at some sensitive receptors may be adverse for some online route options and beneficial for others. However, it is anticipated that there would be no exceedance of annual or short-term mean Nitrogen Dioxide (NO_2), Particulate Matter (PM_{10} and $PM_{2.5}$) and Nitrogen Oxide (N_2O) objectives as a result of any of the online route options. $PM_{2.5}$ concentrations for all online route options are anticipated to have a negligible impact on sensitive receptors, in accordance with Institute of Air Quality Management (IAQM) significance criteria.

Predicted air quality levels at all assessed sensitive receptors would remain well below the objective thresholds of key traffic related pollutants (NO_2, $PM_{10,}$ $PM_{2.5}$ and N_2O) for all proposed online route options. Changes in road transport nitrogen oxides (NOx) concentrations as a result of the online route options are unlikely to give rise to significant effects given their small overall influence on total Nitrogen at the River Tay SAC. Potential impacts on air quality as a result of the proposed online route options are therefore not likely to be significant.

Detailed mitigation is not yet known at this DMRB Stage; however, based on the results of this assessment, i.e. impact on air quality is not likely to be significant; it is unlikely that any operational mitigation would be required for any of the route options.

Offline Route Options

Sensitive receptors within 50m of the proposed offline route options would be those at greatest risk of nuisance associated with construction related dust. With the implementation of appropriate mitigation, impacts from construction activities not likely to be significant across all route options.

A total of 46 sensitive receptors were identified within 200m of the offline route options, 15 are expected to have an adverse change in local air quality during operation. With the implementation of appropriate mitigation, impacts from construction activities for any of the online options are unlikely to be significant. Local air quality effects at some sensitive receptors may be adverse for some online route options and beneficial for others.

Predicted air quality levels at all assessed sensitive receptors are expected to remain well below the objective thresholds of key traffic related pollutants (NO_2, $PM_{10,}$ $PM_{2.5}$ and N_2O) for the offline route options. The offline route options are expected to reduce local emissions on the River Tay SAC due to the offline sections being further away from these designated sites.

Detailed mitigation is not yet known; however, it is unlikely that any operational mitigation would be required for any of the route options.

Comparison

Air quality objective thresholds are unlikely to be exceeded for either online or offline route options and are unlikely to give rise to significant effects, given their small overall influence on total Nitrogen at the site. The offline route options are expected to impact more sensitive receptors than the online route options. The offline route options would be expected to reduce road transport NOx concentrations on the River Tay SAC ecosystems and have a beneficial change in air quality at five sensitive receptors that are currently exposed to local emissions due to their close proximity to the existing A9. However there is no significant difference between the online and offline route options in terms of air quality.

3.2.8 Noise and Vibration

Online Route Options

The online route options will result in adverse impacts at between 101 to 102 residential dwellings and six other noise sensitive receptors (dependent on the online route options). Of these, the majority of impacts are Negligible to Minor; however, potential Moderate adverse impacts are predicted at 17 to 20 dwellings (dependent on the online route options) and there are no anticipated Major adverse impacts. Negligible/Minor beneficial impacts are predicted at 1 to 2 residential dwellings and one other noise sensitive receptor.

An appropriate mitigation strategy and associated mitigation measures would be developed during future design development to avoid or reduce adverse impacts. Potential mitigation measures include the use of a low noise road surfacing material, which can reduce noise levels by approximately 3.5dB $L_{A10,18hr}$ when compared with conventional hot rolled asphalt surfacing of 2mm texture depth (although this is only valid for sections of road with traffic speeds in excess of 75kmh) if appropriate, and/or noise barriers along some sections. It should be noted that isolated areas of low noise surfacing are currently present within the existing A9 carriageway.

Offline Route Options

It is predicted that Offline Route Option 1 will result in adverse impacts at 90 residential dwellings and six other noise-sensitive receptors. Of these, 37 dwellings are predicted to have Major adverse impacts and 14 dwellings are predicted to have Moderate adverse impacts. Beneficial impacts are predicted at 15 residential dwellings and one other noise sensitive receptor. Offline Route Option 2 is predicted to result in adverse impacts at 87 residential dwellings and six other noise-sensitive receptors at scattered rural properties and some properties within the settlements of Dowally, Guay and Kindallachan in close proximity to the offline route options. Of these, 37 dwellings are predicted to have Major adverse impacts and 14 dwellings are predicted to have Moderate adverse impacts. Beneficial impacts ranging from Negligible to Major are predicted at 18 residential dwellings and one other noise sensitive receptor.

An appropriate mitigation strategy and associated mitigation measures would be developed during future design development to avoid or reduce adverse impacts. Potential mitigation measures include the use of a low noise road surfacing material, which can reduce noise levels by approximately 3.5dB LA10,18hr when compared with conventional hot rolled asphalt surfacing of 2mm texture depth (although this is only valid for sections of road with traffic speeds in excess of 75kmh) if appropriate, and/or noise barriers along some sections. It should be noted that isolated areas of low noise surfacing are currently present within the existing A9 carriageway which are to be utilised as part of the offline route options.

Comparison

The online and offline route options are expected to impact negatively on a similar total number of noise sensitive receptors. However, the online route options have no Major adverse impacts on dwellings and the offline options both have 37. The offline route options have a greater number of dwellings (16 to 17 depending on the route option) expected to have a beneficial impact (Negligible to Major) than the online route options. The offline route options will increase noise and vibration impacts at properties that are more remote from the existing A9 and only currently experience low levels of noise from the side road network and A9. As a result, the assessment identifies the offline route options as less favourable in terms of noise and vibration.

3.2.9 Effects on All Travellers

Online Route Options

There are a number of potential NMU impacts including significant impacts on pre-mitigation NMU routes associated with all online route options and side road options. The proposed offline route options would result in potential impacts on 12 NMU routes.

There would be an increase in journey length on seven routes (including Regional Cycling Route 83) and change in journey length for an additional five paths. There would be decrease in amenity value for NMUs using ten paths and change in amenity for one further path. At this stage, path diversion routes are not confirmed and therefore magnitude and significance of impacts have not been identified and further design development in the form of embedded mitigation is anticipated to reduce the potential impacts to non-significant.

Potentially significant impacts on the views from the proposed online route options from Kindallachan (approx. Ch.6100) to Haugh Cottages (approx. Ch.7500) are associated with all online route options in combination with both Side Road Options 1 and 2. This is due to (1) the introduction of the new overbridge and associated embankments, which would obstruct views across the strath towards the rising hills, (2) the large scale revised cuttings (graded out to integrate with the existing landform) on approach to Cuil-an-Duin between Ch. 6800 to Ch. 7300, and (3) the retaining wall at Ch.7350 to 7500. Following the establishment of mitigation planting, impacts associated with the revised cuttings would be reduced. However, impacts are likely to remain of Moderate significance due to the visual prominence of the overbridge and associated earthworks.

Mitigation for NMUs (such as re-routing of existing paths, creation of new paths and cycleways and improvement in amenity of paths) would require to be embedded into the detailed design. Key mitigation for views from the road would include planting, grading out of embankments and cuttings, treatment of rock cuttings and sensitive design of bridge structures and retaining walls.

Offline Route Options

There are a number of potential NMU impacts including significant impacts on pre-mitigation NMU routes associated with the offline route options and side road options.

Offline Route Option 1 would result in potential impacts on one NMU crossing point and 12 NMU routes. Offline Route Option 2 would have a slightly greater impact of truncation of journeys on an additional two paths from Offline Route Option 1.

The offline route options would have an increase in journey length for five NMU routes (including Regional Cycling Route 83), change in journey length for an additional five paths. There would be decrease in amenity value for five paths, an increase in amenity for three paths and no change in amenity for an additional four paths. At this stage, path diversion routes are not confirmed and therefore magnitude and significance of impacts have not been identified. Design development in the form of embedded mitigation is anticipated to reduce the potential impacts to non-significant.

The views from Offline Route Option 1 are generally predicted to be more diverse and interesting than those from the existing A9, although the retaining wall at the northern end of the offline route option would have a negative effect on views from the road. Offline Route Option 2 views on the northbound side would not feature a new side road in the foreground (present with Offline Route Option 1). The negative effect of views of the retaining wall at the northern end of the scheme would also be experienced, and this would be of a taller and longer structure.

Mitigation for NMUs (such as re-routing of existing paths, creation of new paths and cycleways and improvement in amenity of paths) would require to be embedded into the detailed design. Key

mitigation for views from the road would include planting, grading out of embankments and cuttings, treatment of rock cuttings and sensitive design of bridge structures and retaining walls.

Comparison

Both the online and offline route options have a number of potentially significant impacts on NMUs pre-mitigation. All options would increase journey lengths and change amenity for some NMUs routes (including Regional Cycling Route 83). The offline route options would potentially have more diverse and interesting views from the road than the online route options. However, the retaining wall at the northern extents of the route would have an adverse effect on views from the road.

It is considered that the effect of all travellers is generally comparable between online and offline route options.

3.2.10 Materials

Online Route Options

All online route options are likely to require substantially more cut than fill, meaning that they will all generate significant quantities of material for export and probable disposal (747,500m^3 and 880,500m^3 depending on online route option and side road combination).

One structure and two culvert extensions (maximum length 15m) are required for all four proposed online route options. Additionally, Side Road Option 1 and 2 would require construction of Kindallachan Overbridge which would have a clear span over the A9 of approximately 35m. The cost of structures would be greater for these side road options. The number and cost of structures is taken as a proxy for the volume of material required.

It is not anticipated that residential properties will be demolished within the current design proposals. However one agricultural shed (Dutch Barn at Guay Farm) would require to be demolished.

Offline Route Options

All offline route options are likely to require substantially more cut than fill, meaning that they will all generate significant quantities of material for export and probable disposal (between 882,000m^3 and 1,140,500m^3). Although the number of structures required is the same for each offline route option (three bridges, 28 culverts and one retaining wall), the cost of the structures for Offline Route Option 2 is greater than Offline Route Option 1, due primarily to a longer and taller retaining wall at the northern end of the offline route. The number and cost of structures is taken as a proxy for the volume of material required.

One unoccupied farm cottage at Ballintuim and market garden poly-tunnels at West Countlich (forming part of Alex Butter Market Garden and Landscaping) would require demolition.

Comparison

Total disposal of materials is considerably greater for the offline route options than the online route options. The offline route options require the construction of three significant structures and a larger retaining wall (Offline Route Option 2 only) and the cost of structures is considerably greater (proxies for materials import) than for the online route options. The offline route options would also require more demolition of properties than the online route options.

The offline route options are therefore the least favourable of the options in terms of materials.

3.2.11 Policies and Plans

Online Route Options

An assessment of Development Plan Policy Compliance shows that all online route options pose non-compliance issues for Cultural Heritage. Further assessment of the detailed design and mitigation at DMRB Stage 3 would be undertaken to determine policy compliance for Ecology and Nature Conservation and Effects on all Travellers. All other environmental topics are broadly compliant with policy.

Offline Route Options

An assessment of Development Plan Policy Compliance shows that the offline route options pose non-compliance issues for Community and Private Assets, Ecology and Nature Conservation, and Cultural Heritage. Further assessment of the detailed design and mitigation at DMRB Stage 3 would be undertaken to determine policy compliance for Geology, Soils and Groundwater, Road Drainage and the Water Environment, Landscape/Visual, Noise and Vibration and Effects on all Travellers. The remaining environmental topics (Air Quality and Materials) are broadly compliant with policy.

Comparison

The offline route options pose policy non-compliance issues with three environmental parameters (Community and Private Assets, Ecology and Nature Conservation and Cultural Heritage) compared to the online route options posing non-compliance issues with Cultural Heritage only. The online route options are broadly compliant with policy for more environmental parameters (seven) than the offline route options (two).

The offline route options are therefore the least favourable in terms of policies and plans.

3.3 Traffic and Economics

3.3.1 Cost

Online Route Options

There are no significant differences in traffic terms between the various online mainline route options, with Side Road Options 1 and 2 having considerably shorter diversion times for a number of properties in the scheme.

Initial scheme cost estimate ranges have been prepared for each online route option under consideration. The quantifiable items of the works have been measured and a cost per unit has been applied based on rates from similar projects and published data.

The scheme costs for the online route options range from £155M to £254M including optimism bias.

Offline Route Options

As there is no distinction between the mainline alignments the level of traffic on the mainline will be similar under each option and the side road traffic flows will also be similar under each side road option.

Initial scheme cost estimate ranges have been prepared for each offline route option under consideration. The quantifiable items of the works have been measured and a cost per unit has been applied based on rates from similar projects and published data.

The scheme costs for the offline route options range from £320M to £437M including optimism bias.

Comparison

There are no significant differences between the online and offline route options in terms of traffic. However, in terms of economics, the offline route options are significantly more costly. Therefore from a traffic and economic perspective, the offline route options are considered less favourable.

4. Recommendation

A summary of the above assessment in table format is presented in Appendix B which adopts the following colour coding system applied to each parameter considered:

= more favourable than competing option

= less favourable than competing option

= Options are generally comparable

4.1 Benefits of Offline Route Options over Online Route Options

It is recognised that there are certain benefits associated with the offline route options when compared with the online route options including:

Public Utilities

- Due to a reduction in the number of interfaces with public utilities associated with the offline route options.

Road Drainage and Water Environment-Flood Risk (unmitigated)

- The offline route options encroach less into the River Tay 0.5% AEP functional floodplain resulting in an overall lower loss of flood storage.

Cultural Heritage

- The offline route options avoid impacts on the Kindallachan Cairn and Kindallachan Standing Stone Scheduled Monuments.

4.2 Dis-Benefits of Offline Route Options over Online Route Options

The benefits of the offline route options noted in 4.1 above are outweighed by the dis-benefits when compared to the online route options as follows:

NMU

- The offline route options would likely require the construction of grade separated crossings to accommodate the retention of NMU connectivity, which are not required with the online route options.

Structures

- The offline route options require the construction of three significant structures (Dowally – 66m span, Guay – 140m span and Kindallachan – 260m span) and a larger retaining wall (Offline Route Option 2 only).

Constructability

- Due to the difficulties associated with the construction of the structures on the offline route options and the extensive earthworks that are required, an online solution is deemed more favourable in this instance despite the increased traffic management requirements associated with online route options.

Community and Private Assets

- The offline route options result in a greater land-take with permanent adverse impacts arising from the loss of up to 45ha of agricultural land and forestry, combined with severance of farms, fields and forestry compartments.

- The offline route options result in more demolitions: an uninhabited residential property; and a number of poly-tunnels associated with a market garden and landscaping business.

Ecology and Nature Conservation

- Although both the online and the offline route options would result in permanent impacts on the River Tay SAC, the offline route options would have the potential to result in more impacts, with some being of a greater magnitude, than online route options due to severance and fragmentation of habitats.

Landscape/Visual

- The offline route options have substantial adverse impact upon landscape character and on numerous visual receptors, including residents of properties that currently have no visibility of the existing A9. These impacts would be greatest along the offline section and associated with three prominent elevated bridge structures with effective mitigation not achievable.

Noise and Vibration

- The offline route options have 37 more Major adverse impacts on dwellings than the online route options. The offline route options increase noise and vibration impacts at properties more remote from the existing A9 and only currently experience low levels of noise from the side road network and the A9.

Materials

- The offline route options result in more disposal of surplus material of between 882,000m^3 and 1,140,500m^3 due to an increase in earthworks required to construct the offline route options. There is also an increased materials impact due to the need to construct three significant structures and a larger retaining wall (Offline Route Option 2 only) and an increased need to demolish properties which are not required for the online route options.

Policies and Plans

- The offline route options pose policy non-compliance issues with more environmental parameters: Community and Private Assets, Ecology and Nature Conservation and Cultural Heritage compared to Cultural Heritage only for the online route options.

Cost

- The structures cost of the offline route options are greater than the online route options because they require construction of three significant bridge structures.

- The range of costs for the offline route options is considerably greater than the costs for the online route options.

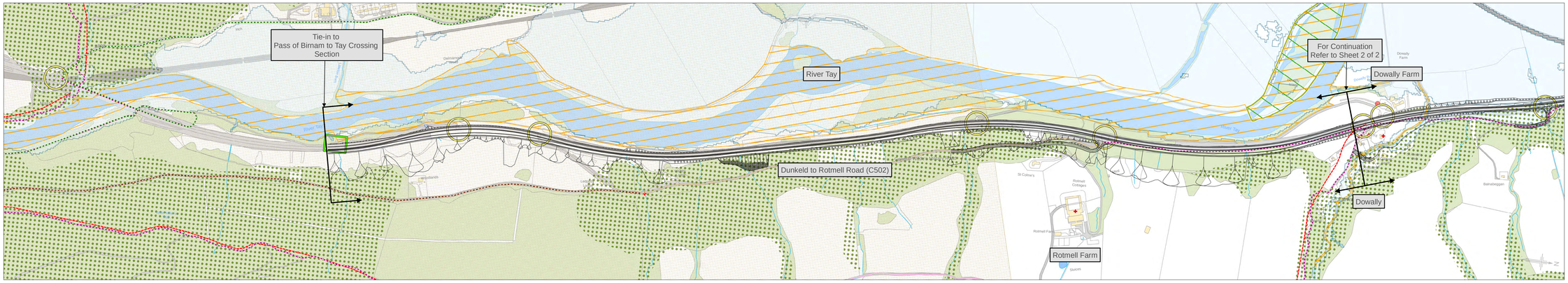
4.3 Summary

It should be noted that both the online and offline route options meet the programme objectives and all route options are comparable with regards the remaining parameters examined as part of the assessment.

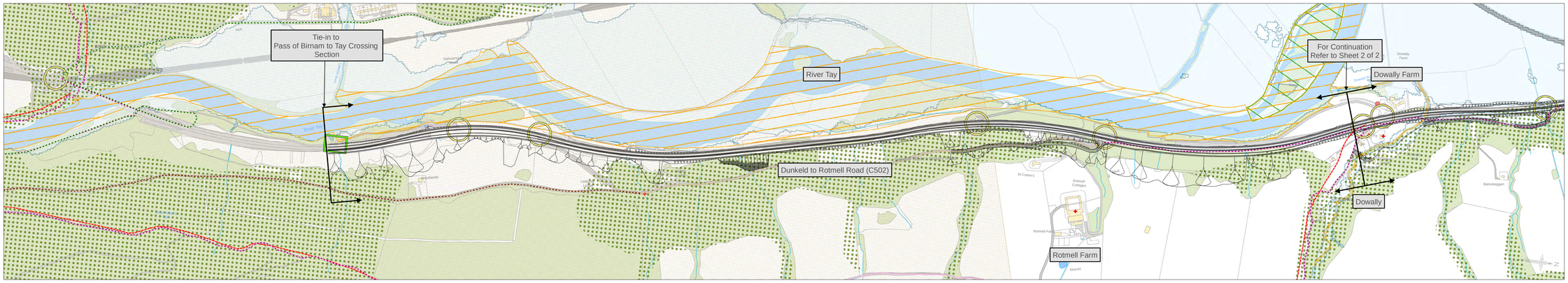
Based on the assessment undertaken, it is recommended that the offline route options are not progressed for further consideration.

APPENDIX A – ONLINE AND OFFLINE ROUTE OPTIONS DRAWINGS

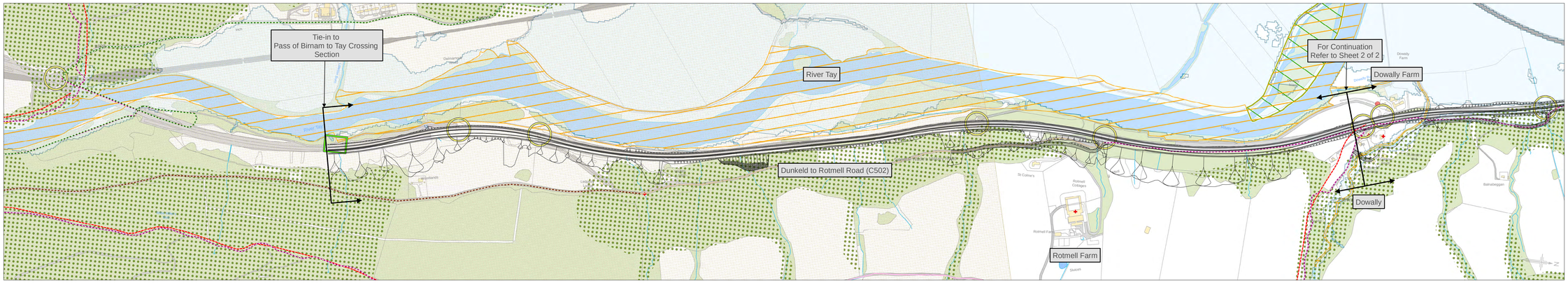
ONLINE ROUTE OPTION 1 - PREDOMINANTLY WIDENING TO THE SOUTHBOUND SIDE



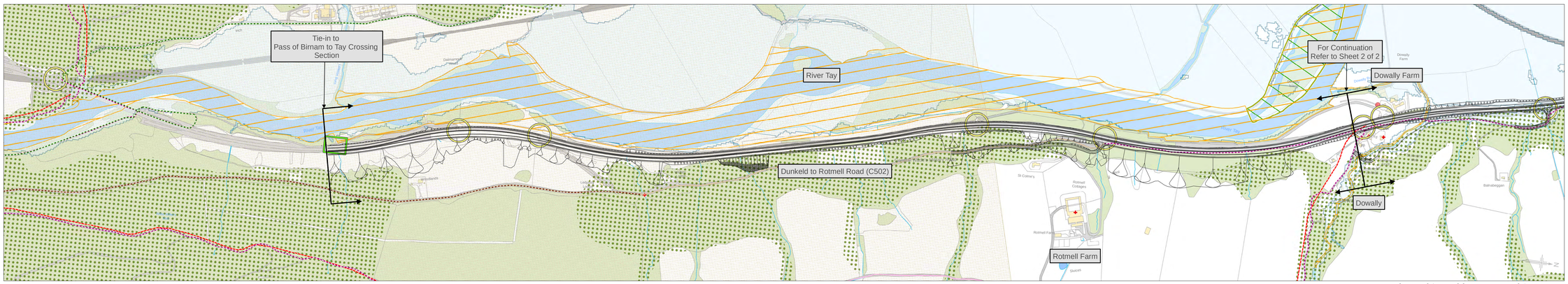
ONLINE ROUTE OPTION 2 - PREDOMINANTLY WIDENING TO THE SOUTHBOUND SIDE

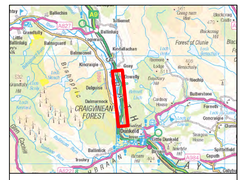


ONLINE ROUTE OPTION 3 - PREDOMINANTLY WIDENING TO THE SOUTHBOUND SIDE



ONLINE ROUTE OPTION 4 - PREDOMINANTLY WIDENING TO THE SOUTHBOUND SIDE





Legend - Constraints

- Proposed Scheme
- Cutting
- Embankment
- Structure
- Existing Junction/Access
- Existing Structure
- Perth & Kinross Core Path
- A Listed Building
- B Listed Building
- C Listed Building
- Scheduled Monument
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Ancient Woodland Inventory
- SEPA 1 in 200 year Fluvial Flood Zone

Rev.	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
0	21/06/2016	For Information	HCH	PH	MP	AJG

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TAY CROSSING TO BALLINLUIG STRIP PLANS ONLINE ROUTE OPTIONS

SHEET 1 OF 2

Drawing Status	FOR INFORMATION	
Scale	1:5,000	DO NOT SCALE
Jacobs No.	B2140003	
Drawing number	B2140003/SK/124	Rev. 0

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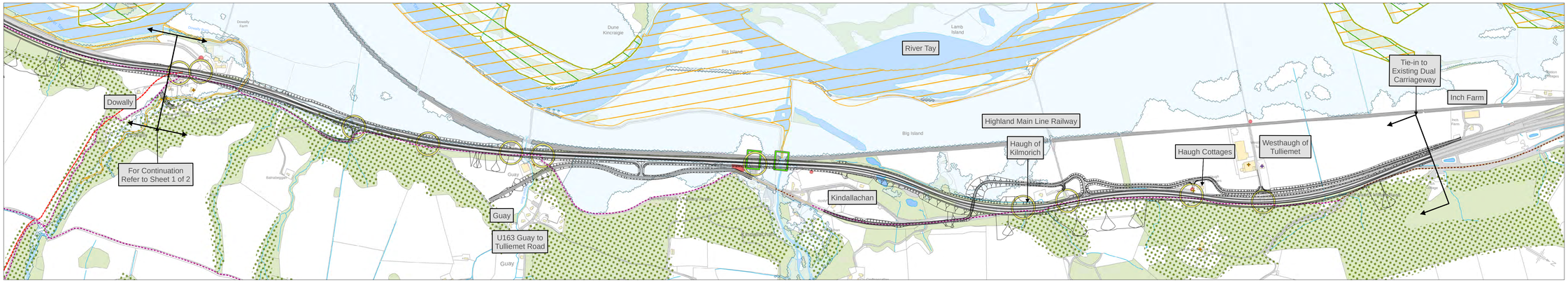
0 0.1 0.2 0.4 0.6 0.8 1 Kilometres

ONLINE ROUTE OPTION 1 - PREDOMINANTLY WIDENING TO THE NORTHBOUND SIDE PRIOR TO GUAY AND SOUTHBOUND SIDE BEYOND GUAY



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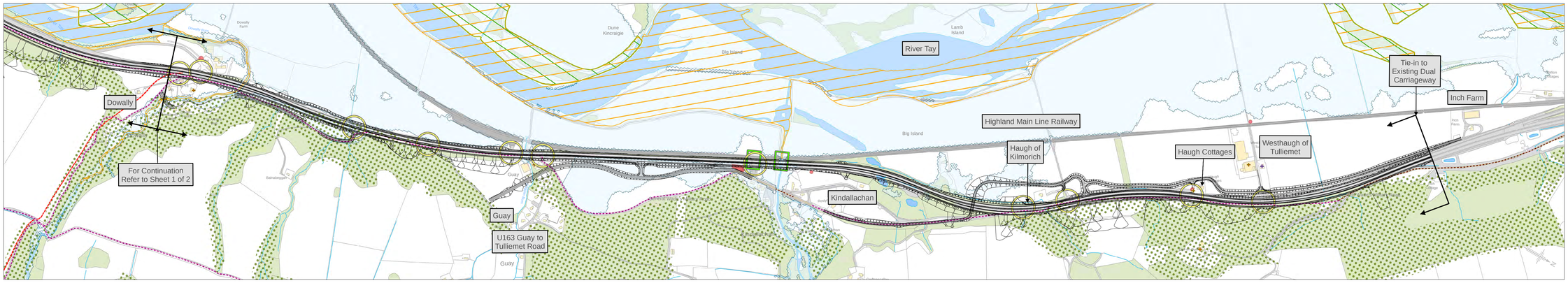
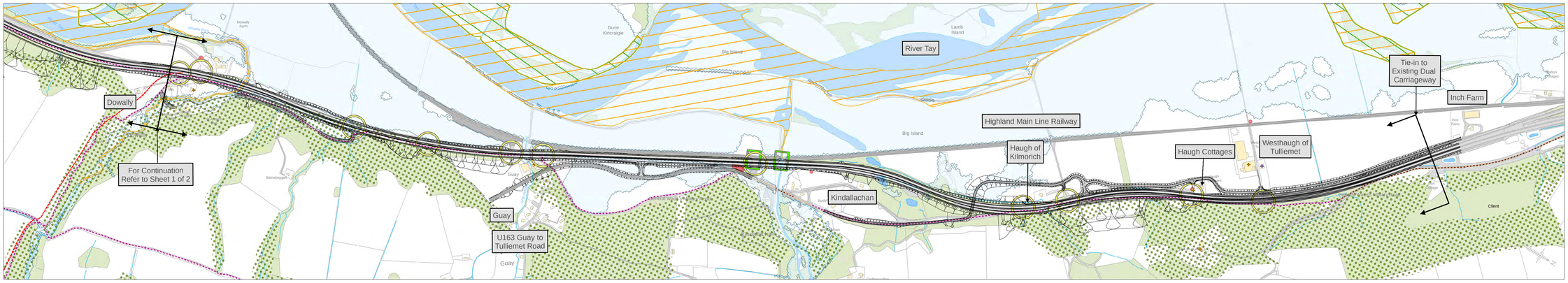
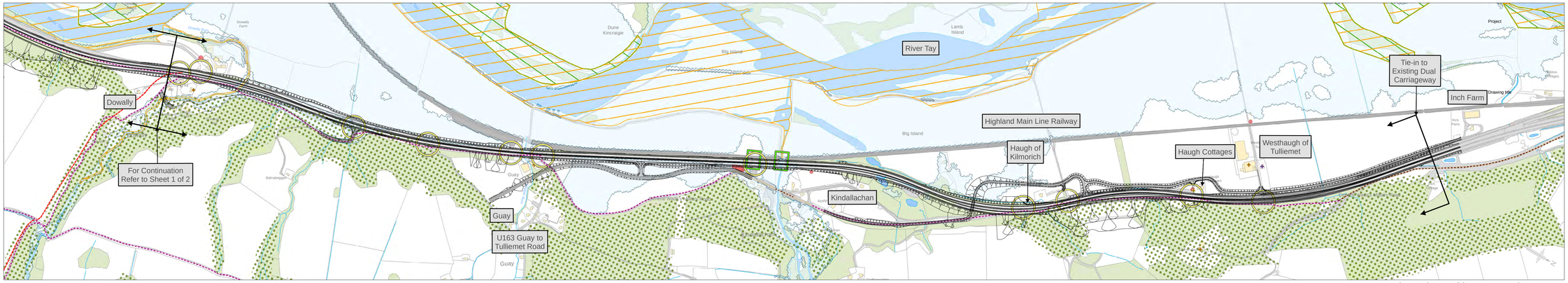


ONLINE ROUTE OPTION 3 - PREDOMINANTLY WIDENING TO THE SOUTHBOUND SIDE PRIOR TO HAUGH COTTAGES AND NORTHBOUND SIDE BEYOND HAUGH COTTAGES



ONLINE ROUTE OPTION 4 - PREDOMINANTLY WIDENING TO THE NORTHBOUND SIDE PRIOR TO GUAY, SOUTHBOUND SIDE PRIOR TO HAUGH COTTAGES AND NORTHBOUND SIDE BEYOND HAUGH COTTAGES



Legend - Constraints

- Proposed Scheme
- Cutting
- Embankment
- Structure
- Existing Junction/Access
- Existing Structure
- Perth & Kinross Core Path
- A Listed Building
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PERTH TO INVERNESS
Tay Crossing to Ballinluig

Project

Drawing title

TAY CROSSING TO BALLINLUIG
STRIP PLANS
ONLINE ROUTE OPTIONS

SHEET 2 OF 2

Drawing Status	FOR INFORMATION
Scale	1:5,000 DO NOT SCALE
Jacobs No.	B2140003
Drawing number	B2140003/SK/125
Rev.	0

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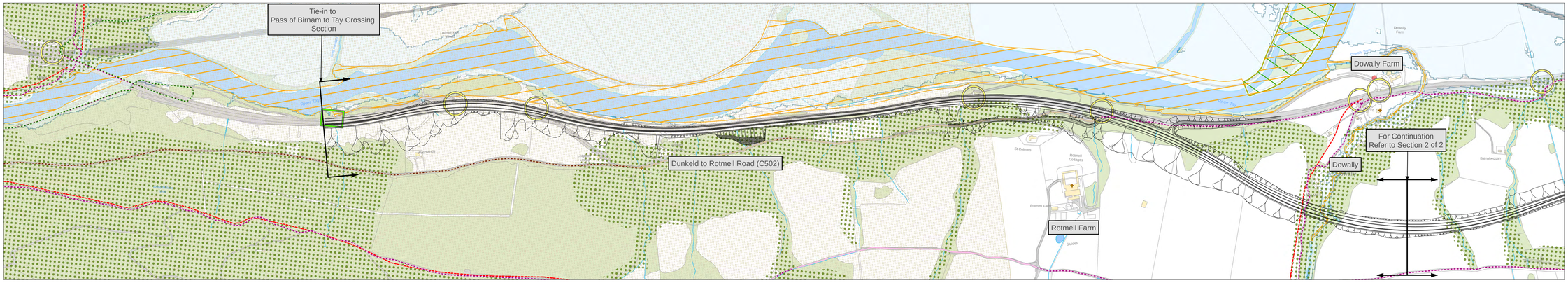
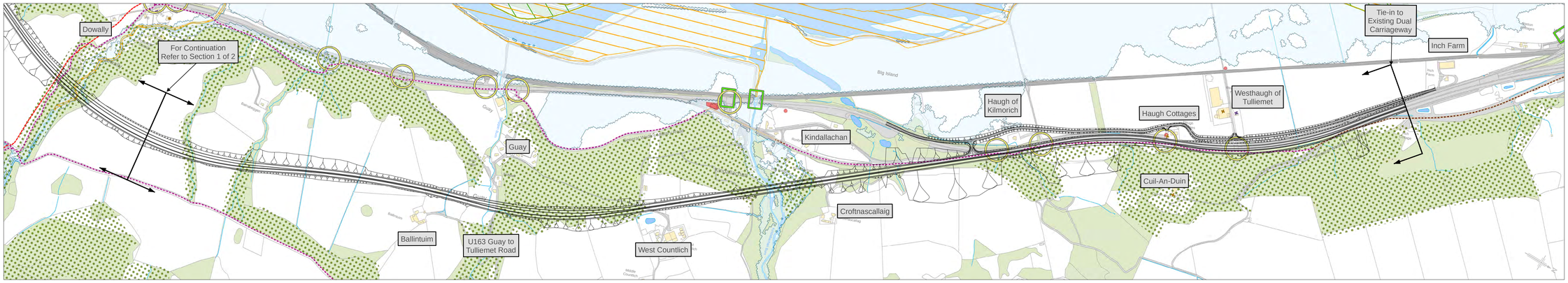
0 0.1 0.2 0.4 0.6 0.8 1 Kilometres

OFFLINE ROUTE OPTION 1 (SECTION 1 OF 2)

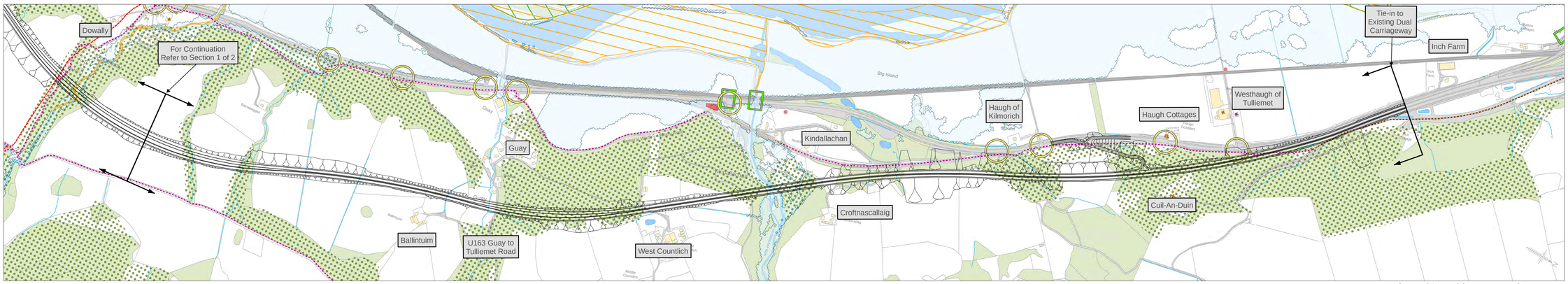


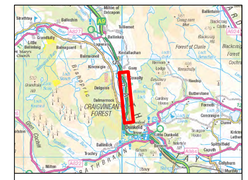
OFFLINE ROUTE OPTION 1 (SECTION 2 OF 2)



OFFLINE ROUTE OPTION 2 (SECTION 1 OF 2)

OFFLINE ROUTE OPTION 2 (SECTION 2 OF 2)





Legend - Constraints

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- Existing Junction/Access
- Existing Structure
- Perth & Kinross Core Path
- Local Paths
- Rights of Way
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TAY CROSSING TO BALLINLUIG STRIP PLANS OFFLINE ROUTE OPTIONS

Drawing Status	FOR INFORMATION
Scale	1:5,000 DO NOT SCALE
Jacobs No.	B2140003
Drawing number	B2140003/SK/126
Rev.	0

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0 0.1 0.2 0.4 0.6 0.8 1 Kilometres

	Online Route Options	Offline Route Options	Commentary
Engineering			
Design Standards - Relaxations - Departures			The online route options require a single Departure from Standards on the approach to the left-in, left-out junction located at Haugh of Kilmorich while the offline route options do not require any Departure from Standards. In addition, the online route options include up to 22 relaxations associated with each of the mainline alignments while the offline route options include up to 6 relaxations. All route options have an impact on the existing Dowally to Rotmell (C502) road junction. Both the online and offline route options require the inclusion of a replacement junction which has the same design and configuration for both the online and offline route options. Both the online and offline route options are considered robust and safe in the context of their engineering design.
Local Road Network / Accesses - Accessibility - Impact on Design Standards			All route options have an impact on the existing side road network. The online route options will impact on the side road network between Dowally and Guay while the offline route options will impact existing accesses at the northern extents of the route. The online route options with Side Road Options 1 and 2 will provide access to and from both northbound and southbound carriageways of the dualled A9. The offline route options only provides access to the northbound carriageway which results in an increase in journey times for residents within the scheme seeking to travel to the south or gain access to their properties from the north. Both the online and offline options include side road options which result in diversion times of up to 9 minutes, albeit there are side road options available to the online options which minimises diversion times. However for the purposes of this comparison in the context of the local road network and accesses between online and offline route options, it is considered that both options are generally comparable.

	Online Route Options	Offline Route Options	Commentary
Engineering			
Non-motorised Users (NMUs) - Engineering Impact			All online route options will impact Core Paths, RCR and local paths currently located alongside the existing A9 and will require realignment for large sections of the route. The offline route options will impact on Core Paths, RCR and local paths currently located adjacent to the online section of carriageway and will result in the segregation of these routes where it deviates from the online alignment. The offline route options will potentially result in the need to construct either a parallel NMU route or grade separated crossings at either end of the offline section which is not required for the online route options. Although alternative NMU routes have yet to be designed for either the online or offline route options, the likely need to construct grade separated crossings to support the offline route options result in the offline route options being considered less favourable than the online route options.
Geotechnics and Earthworks (Import and Disposal Figures shown)	747,500 to 880,500 cub m (Export)	882,000 to 1,140,500 cub m (Export)	The offline route options results in an increase in the volume of surplus material generated when compared with the online route options as highlighted in the ranges of surplus material for the options. The risk of landslides occurring is similar for the online and offline route options, based on studies carried out to date. However for the purposes of this comparison in the context of Geotechnics and Earthworks between online and offline route options, it is considered that both options are generally comparable.
Hydrology and Drainage - Watercourse Crossings - Drainage Design			All mainline route options affect the same number of named watercourse crossings therefore hydrology is not a differentiator between route options. A high level assessment has confirmed a drainage solution can be provided for all route options and is therefore not a differentiator between the mainline route options.

	Online Route Options	Offline Route Options	Commentary
Engineering			
Structures			The online route options require two structures and two culverts to be extended over the three main watercourses (Dowally Burn, Sloggan Burn and Kindallachan Burn) and a retaining wall to be constructed in the northern section, with average ranges in height of between 2.1m and 3.7m located to the north of Cuil an Duin. The offline route options have three new significant structures with large spans over the same three watercourses (Dowally Burn - 66m span, Sloggan Burn - 140m span and Kindallachan Burn - 260m span). Offline Route Option 1 requires a retaining wall with an average height similar to the online route options however Offline Route Option 2 has a retaining wall height of up to 17.9m in the vicinity of Cuil-an-Duin. As the offline route options include three significant structures, this is considered less favourable than the online route options under consideration.
Public Utilities			The online route options have a greater impact on public utilities with up to 37 identified interfaces. The offline route options have 16 identified interfaces with public utilities and two potential interfaces with private utilities (Dowally and Kindallachan Hydro Schemes) which will result in a significant decrease in the scale of diversionary work required. The online route options are therefore less favourable than the offline route options.

	Online Route Options	Offline Route Options	Commentary
Engineering			
Constructability			Three significant structures associated with the construction of the offline route options which potentially require difficult construction techniques including erection of temporary structures due to the location, height and span of the structures. Widening into the hillside and into the flood plain will require careful consideration. Although the online route options runs alongside a longer section of floodplain when compared to the offline route options, it is considered that the impact of construction within the River Tay 1 in 200 year flood plain is generally comparable as both the online and offline options will still require careful consideration. Offline construction is typically more favourable than online construction due to the reduced need to operate traffic management during the construction process. However, due to the difficulties associated with the construction of the structures on the offline route options and the extensive earthworks that are required, the online route options are deemed more favourable than the offline route options in this case despite the increased traffic management requirements associated with online widening.

	Online Route Options	Offline Route Options	Commentary
Environment			
Community and Private Assets			The offline route options affect a smaller number of residential properties (maximum 7) than the online route options (maximum 16) and a similar number of commercial/industrial properties (2-3) are affected by both the online and offline route options. Overall land-take would be similar between the online route options and Offline Route Option 1. The main differences are the loss of parking (0.10ha) at St Annes Church, which would only be required for the online route options and the greater land-take from commercial/industrial property associated with Offline Route Option 2. Relief from community severance (easier access to St Annes Church and northbound bus stop) is expected from the offline route options due to reduced traffic volumes on the de-trunked A9. Future design development would be required to address access to the bus stops from the southbound carriageway of the offline route options. There is generally no change to existing community severance for online route options. Three land interests would be impacted by all online and offline route options. However, the offline route options would be expected to affect more farming businesses as the routes pass through tenanted land. Total land-take and agricultural land severance (particularly affecting tenanted land at Rotmell, West Countlich and Ballintuim) would both be greater for the offline route options, and the offline route options would also result in the demolition of poly-tunnels at East Countlich (Alex Butter Market Garden and Landscaping) and an unoccupied farm cottage at Ballintuim. The online route options (side roads) would result in demolition of a dutch barn at Guay, which would be unaffected by the offline route options. Overall, the offline route options are considered less favourable than the online route options in terms of community and private assets, primarily due to agriculture, land and severance impacts.

	Online Route Options	Offline Route Options	Commentary
Environment			
Geology, Soils and Groundwater			The online and offline route options are expected to have similar impacts on geology, soils and groundwater. The online route options would require widening of existing cuttings and construction of new cuttings at nine sites compared to 11 sites for the offline route options. Cutting depths are similar between online and offline route options ranging from 2m to 22m and between eight and ten of the cuttings would be likely to intercept groundwater. Both online and offline route options have the potential to have direct and indirect impacts on potentially contaminated land sites. Mitigation taking into account best practice, legislation and guidance in combination with ground investigation would be expected to be employed to reduce or avoid contaminated land and groundwater impacts. There is no significant difference in terms of geology, soils and groundwater between the online and offline route options.
Road Drainage and Water Environment -			Although the online route options impact fewer water features, the offline route options has a reduced encroachment within the 1:200 year functional floodplain. Therefore, without mitigation the online route options are considered to be the less favourable in terms of water quality and fluvial geomorphology. Mitigation measures and side road design refinement can be incorporated to reduce the impact on the loss of functional floodplain for both the online and offline route options.
Ecology and Nature Conservation			All of the online and offline route options result in impacts on the River Tay SAC and on habitat listed on the AWI. The offline route options are associated with more habitat loss than the online route options, particularly as it transects habitat listed on the AWI (primarily category 1a and 2a habitat). Land-take of habitat listed on the AWI would be between 14.3ha and 16.9ha for the offline route options and between 11.0ha and 15.0ha for the online route options. The offline route options have a greater impact on severance of habitats when compared to the online route options. The greater impacts associated with offline route options identify it as less favourable than the online route options in terms of Ecology and Nature Conservation.

	Online Route Options	Offline Route Options	Commentary
Environment			
Landscape / Visual			The offline route options have substantially greater landscape and visual impacts than the online options due to the alignment deviating off-line, away from the existing established transport corridor at the edge of the flat valley floor, to the relatively unspoiled and tranquil undulating higher ground of the valley slopes. This would result in the need for three large scale prominent structures and associated earthworks to negotiate the crossings of intimate small scale valleys at Dowally, Guay and Kindallachan and through areas of mature AWI woodland. The route would be prominent in the landscape, sitting at a higher elevation with sections on high embankment, whereas the online route options would all be relatively subdued, at the edge of the flat valley floor, sitting against a backdrop of the valley slopes and woodland. The offline route options would cause new visual impacts at a number of rural properties that are currently unaffected by views of the A9 and a number would gain views of the prominent elevated bridge structures with effective mitigation unlikely to be achieved, whereas the majority of receptors affected by the online route options currently gain views of the existing A9. The offline route options are therefore considered less favourable than the online route options in terms of landscape and visual impacts.
Cultural Heritage			The online route options would result in the partial removal of Kindallachan Cairn and Kindallachan Standing Stone Scheduled Monuments. These assets would not be affected by the offline route options. However, the offline route options would be expected to have potential impacts on undiscovered archaeological remains. All online and offline route options would be expected to affect the setting of Westhaugh of Tulliemet Cross Slab Scheduled Monument. The online route options are therefore considered less favourable than the offline route options in terms of cultural heritage.

	Online Route Options	Offline Route Options	Commentary
Environment			
Air Quality			Air quality objective thresholds are unlikely to be exceeded for both online and offline route options. The offline route options are expected to impact more sensitive receptors (69) than the offline route options (46). The offline route options would be expected to have a beneficial change in air quality at five sensitive receptors that are currently exposed to local emissions due to their close proximity to the existing A9. The offline route options would be expected to have an adverse change in local air quality at 15 sensitive receptors, five of which currently have little exposure to local emissions from the existing A9 due to their distance from the trunk road. The offline route options are expected to reduce road transport NOx concentrations on the River Tay SAC ecosystems when compared to the online route options. Both online and offline route options are unlikely to give rise to significant effects, given their small overall influence on total Nitrogen at the site. There is no significant difference between the online and offline route options in terms of air quality.
Noise and Vibration			The online and offline route options are expected to impact negatively on a similar total number of noise sensitive receptors. However, the online route options have no Major adverse impacts on dwellings and the offline options both have 37 Major adverse impacts. The offline route options have a greater number of dwellings expected to have a Major beneficial impact than the online route options. The offline route options will increase noise and vibration impacts at properties that are more remote from the existing A9 and only currently experience low levels of noise from the side road network and A9. As a result, the assessment identifies the offline route options as less favourable than the online route options in terms of noise and vibration.
Effects on All Travellers			The offline route options would have an increase in amenity for NMUs using the crossing point CP01 as well as an increase in amenity for three paths (two Core Paths/Regional Cycle routes and one local path) when compared to the online route options. However, additional potential adverse impacts of severance and on amenity for NMUs using other paths may occur due to the offline route options with grade separated crossings potentially required as mitigation. The offline route options would potentially have more diverse and interesting views from the road than the online route options. However, the retaining wall at the northern extents of the route would have an adverse effect on views from the road. There is no significant difference between online and offline route options in terms of effects on all travellers.

	Online Route Options	Offline Route Options	Commentary
Environment			
Materials			Total disposal of materials is expected to be up to 1,140,500m^3 for the offline route options and up to 880,500m^3 for the online route options. The offline route options require the construction of three significant structures and a larger retaining wall (Offline Route Option 2 only) and the cost of structures is considerably greater (proxies for materials import) than for the online route options. The offline route options would require demolition of one unoccupied residential property (Ballintuim Farm Cottage) and 6 poly-tunnels compared to the online route options requiring the demolition of one agricultural shed (Dutch Barn at Guay Farm). The offline route options are therefore considered less favourable than the online route options in terms of materials.
Policies and Plans			The offline route options pose policy non-compliance issues with three environmental parameters (Community and Private Assets, Ecology and Nature Conservation and Cultural Heritage) compared to the online route options posing non-compliance issues with Cultural Heritage only. The online route options are broadly compliant with policy for more environmental parameters (seven) than the offline route options (two). The offline route options are therefore considered less favourable than the online route options in terms of policies and plans.

	Online Route Options	Offline Route Options	Commentary
Other			
Traffic			No differentiator between online and offline route options as there are no grade separated junctions located within the scheme.
Cost	£155M to £254M	£320M to £437M	The key differences between the online and offline route options are summarised as follows: • Structures; and • Preliminaries & Indirect Costs (which is expressed as a percentage of the direct construction cost).
Economics			Although the traffic is similar between the online and offline route options, due to the significant difference in cost, the offline route options are considered less favourable than the online route options.

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