

Appendix 13.1

Slope Profiling

Transport Scotland

August 2018



Table of contents

Chapter	Pages
1. Introduction	1
1.1. The Proposed Scheme	1
1.2. Earthworks Design	1
2. Approach and Methods	2
2.2. Limitations	2
3. Landform Sensitivity	4
3.1. Landform Sensitivity Plans	4
4. Areas of Focused Earthworks Design	10
4.1. Location One: Chainage 5500-7000 (NB)	10
4.2. Location Two: Chainage 5650-5875 (SB)	11
4.3. Location Three: Chainage 10650-11000 (SB)	12
4.4. Location Four: Chainage 22300-23000 (SB)	14
5. Summary	16

Tables

Table 2.1: Landform Sensitivity: Typical Descriptions	2
Table 5.1: Summary of Locations of Embedded Earthworks Mitigation	16

Figures

Figure 3.1: Landform Sensitivity – Ch. 0- 2700	4
Figure 3.2: Landform Sensitivity – Ch. 2700-5300	5
Figure 3.3: Landform Sensitivity – Ch. 5300-7300	5
Figure 3.4: Landform Sensitivity – Ch. 7300-9700	6
Figure 3.5: Landform Sensitivity – Ch. 9700-12000	6
Figure 3.6: Landform Sensitivity – Ch. 12000-14000	7
Figure 3.7: Landform Sensitivity – Ch. 14000-16400	7
Figure 3.8: Landform Sensitivity – Ch. 16400-19500	8
Figure 3.9: Landform Sensitivity – Ch. 19500-22800	8
Figure 3.10: Landform Sensitivity – Ch. 22800-25250	9
Figure 4.1: Illustrative Plan – Chainage 5500-7000	10
Figure 4.2: Illustrative Section – Chainage 6250	10
Figure 4.3: Illustrative Plan – Chainage 5650-5875	12
Figure 4.4: Illustrative Section – Chainage 5675	12
Figure 4.5: Illustrative Section – Chainage 5700	12
Figure 4.6: Illustrative Plan – Chainage 10650-11000	13
Figure 4.7: Illustrative Section – Chainage 10750	13
Figure 4.8: Illustrative Plan – Chainage 22300-23000	15
Figure 4.9: Illustrative Section – Chainage 22400	15
Figure 4.10: Illustrative Section – Chainage 22850	15

Photographs

Photograph 4.1: Wooded landscape adjacent to the A9 to the north of Craigellachie NNR	11
Photograph 4.2: Open undulating landscape viewed from the A95/NCN7	14

1. Introduction

1.1. The Proposed Scheme

- 1.1.1. The A9 Dualling Dalraddy to Slochd DMRB Stage 3 engineering design assessed in the Environmental Impact Assessment (EIA) and reported in this ES is hereafter referred to as the Proposed Scheme and is shown in Figure 5.2 in Volume 3.

1.2. Earthworks Design

- 1.2.1. This technical appendix sets out an overview of the process followed and a summary of the outcomes that arose in considering how the Proposed Scheme could achieve 'best landscape fit' with the existing landform through varying earthwork slope profiles.
- 1.2.2. The main objective of this exercise was to slacken slope profiles at locations where this will achieve a more naturalistic and integrated landform to help embed the Proposed Scheme into the existing landscape, or steepen slopes where the safeguarding of existing landscape cover is desirable in order to maintain the pattern of the landscape and/or screening of the A9 to visual receptors in the area.
- 1.2.3. To achieve a best fit within the landscape, in line with the advice provided within Transport Scotland's Fitting Landscapesⁱ document, slope profiles have been steepened or slackened. These varied slope profiles have been incorporated into the Proposed Scheme design as embedded landscape mitigation.
- 1.2.4. It should be noted that slope profiles have been steepened or slackened at several other specific locations throughout the scheme for engineering and environmental reasons other than landscape fit. Whilst these areas inevitably have an influence on landscape fit, this was not the primary intention of the change in design and consequently these locations are not included within this technical appendix.
- 1.2.5. This approach has adopted the principles of iterative design, as supported by DMRB Interim Advice Note (IAN) 135/10ⁱⁱ, Guidelines for Landscape and Visual Impact Assessment (GLVIA3)ⁱⁱⁱ and Fitting Landscapes: Securing More Sustainable Landscapesⁱ. All three documents were used to both inform and guide the assessment process.
- 1.2.6. IAN 135/10 states that *'Mitigation should be addressed as an intrinsic part of the assessment process, amending the design wherever possible to avoid or reduce landscape and/or visual impacts as part of an iterative process'*.
- 1.2.7. It is stated within GLVIA3 that *'EIA itself can be an important design tool. It is now usually an iterative process, the stages of which feed into the... design of the project. The iterative design and assessment process has great strength because it links the analysis of environmental issues with steps to improve the... design of a particular scheme'*.
- 1.2.8. The basis for this exercise to be undertaken is outlined within Fitting Landscapes, which encourages designers and managers to promote *'bespoke and locally appropriate solutions [in order to] promote design and place quality'*. Furthermore, it states that *'delivering project outcomes requires landscape architects to assist the design team in preparing integrated solutions. This is of particular importance in the engineering and landscape integration of... earthworks and landforms'*.
- 1.2.9. A summary, of all planning policy considered in relation to the landscape can be found within Chapter 19: Policies and Plans.

2. Approach and Methods

- 2.1.1. The alignment of the Proposed Scheme and the design of associated earthworks has been developed through an iterative design process involving engineering, environmental and landscape specialists in order to reduce landscape and visual impacts, integrate the road with the surrounding landscape and provide a pleasant experience for travellers. Physical characteristics of the landscape were considered in addition to more perceptual and experiential characteristics.
- 2.1.2. This exercise was informed by both field surveys and desk study, which includes a review of relevant Landscape Character Assessments, discussed in more detail in Chapter 13: Landscape.
- 2.1.3. The landform sensitivity of the route was determined to identify particular areas which required a more sensitive approach to the earthworks design. The criteria considered includes landscape sensitivity, visual prominence and type of vegetation cover. The scheme was subdivided into smaller sections based on the level of sensitivity that was established for each section based on the typical descriptions described in Table 2.1 below. The methodology was created specifically for this project and relies on professional judgement informed by localised landscape character.

Table 2.1: Landform Sensitivity: Typical Descriptions

Level of Sensitivity	Typical Description
Level 1	Small sections of earthworks, where mitigation planting is appropriate and therefore the landform is unlikely to be perceptible.
Level 2	Open landscapes with relatively minor topographic variation where appropriate mitigation planting is limited to scattered or small groups of trees and the landform is more likely to be perceptible. Or, enclosed landscapes where the landform is in close proximity to visual receptors and of sufficient scale that it can be perceived despite a wooded appearance.
Level 3	Specific locations that are highly visible, environmentally sensitive and therefore require a detailed specification of slope. Areas where mitigation planting is generally inappropriate and the landform is consequently more perceptible.

- 2.1.4. Identification of landform sensitivity has been considered separately in relation to the northbound (NB) and southbound (SB) A9 carriageways. Mapping of landform sensitivity across the scheme can be found on Figures 3.1-3.10.
- 2.1.5. Following this exercise, modifications to the proposed earthwork slope gradient were identified with locations specified by chainage and listed within Section 4 to the nearest 10m. All of the modifications outlined have been included within the Proposed Scheme as specific landscape embedded mitigation.

2.2. Limitations

- 2.2.1. Only a high-level exercise has been conducted to consider the overall gradient of the slope. It is accepted that further measures to integrate the proposed earthworks into the landscape, such as more detailed variation in slope profiling at specific locations to tie-in with the adjacent landscape, are to be considered within detailed design.
- 2.2.2. Rock Cuts have been considered separately and are described in further detail in Appendix 13.2: Rock Cuts.

- 2.2.3. Despite the recognised benefits of returning land to productive use as identified within Fitting Landscapesⁱ, as this was a high-level exercise, detailed discussions with landowners regarding potential to return slackened slopes were not undertaken at this stage. Consequently, although it is mentioned where there is a possibility to return land to productive use, it was not a material consideration in the decision-making process.
- 2.2.4. Whilst it is recognised that the steepening and slackening of earthworks along the A9 has the potential to bring about the various environmental and financial benefits of a balanced requirement for cut and fill, detailed calculations were not available whilst undertaking this exercise, therefore this has not been a material consideration in the decision-making process.

3. Landform Sensitivity

3.1. Landform Sensitivity Plans

3.1.1. Figure 3.1 to Figure 3.10 below illustrate the landform sensitivity of the landscape adjacent to both the NB and SB carriageway as assessed in accordance with the methodology outlined in Table 2.1.

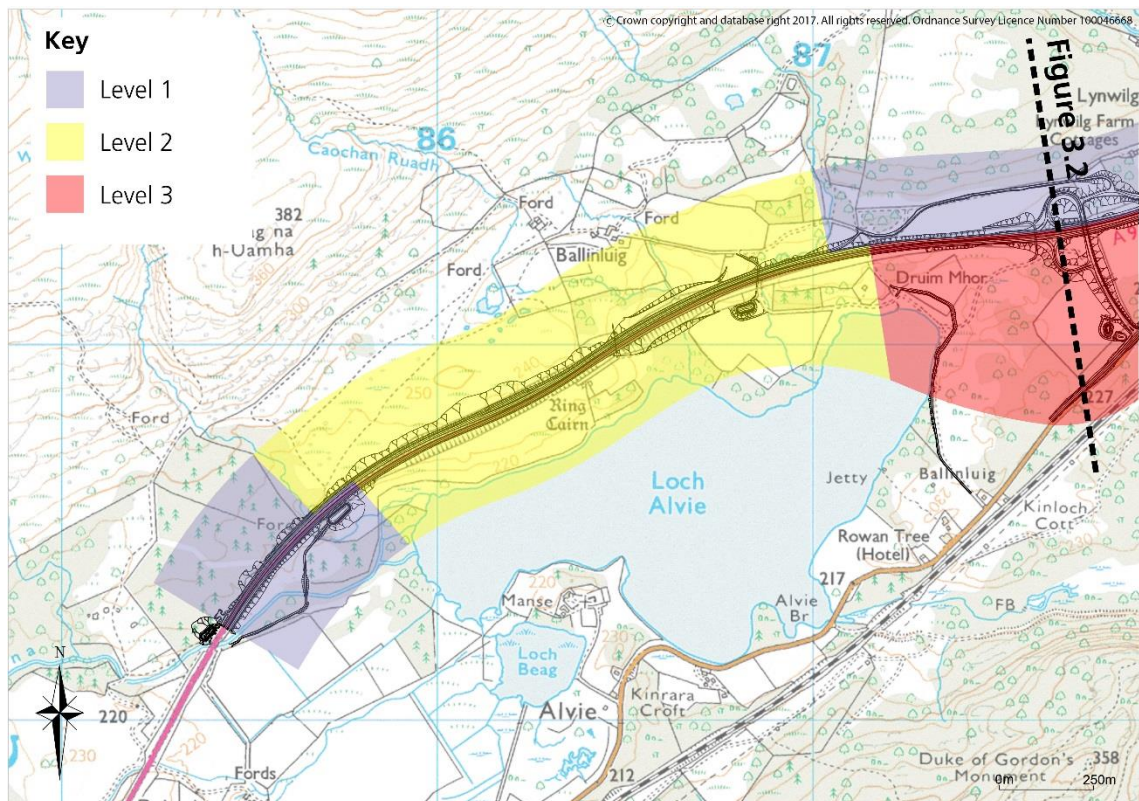


Figure 3.1: Landform Sensitivity – Ch. 0- 2700

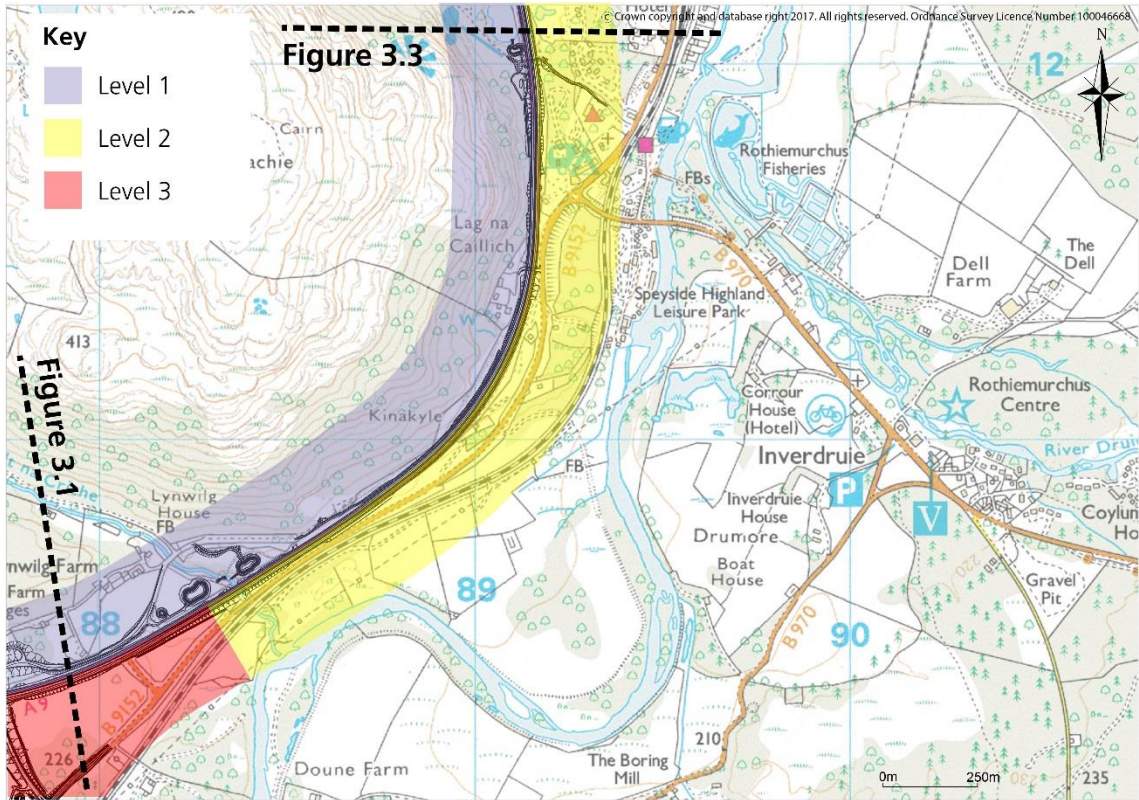


Figure 3.2: Landform Sensitivity – Ch. 2700-5300

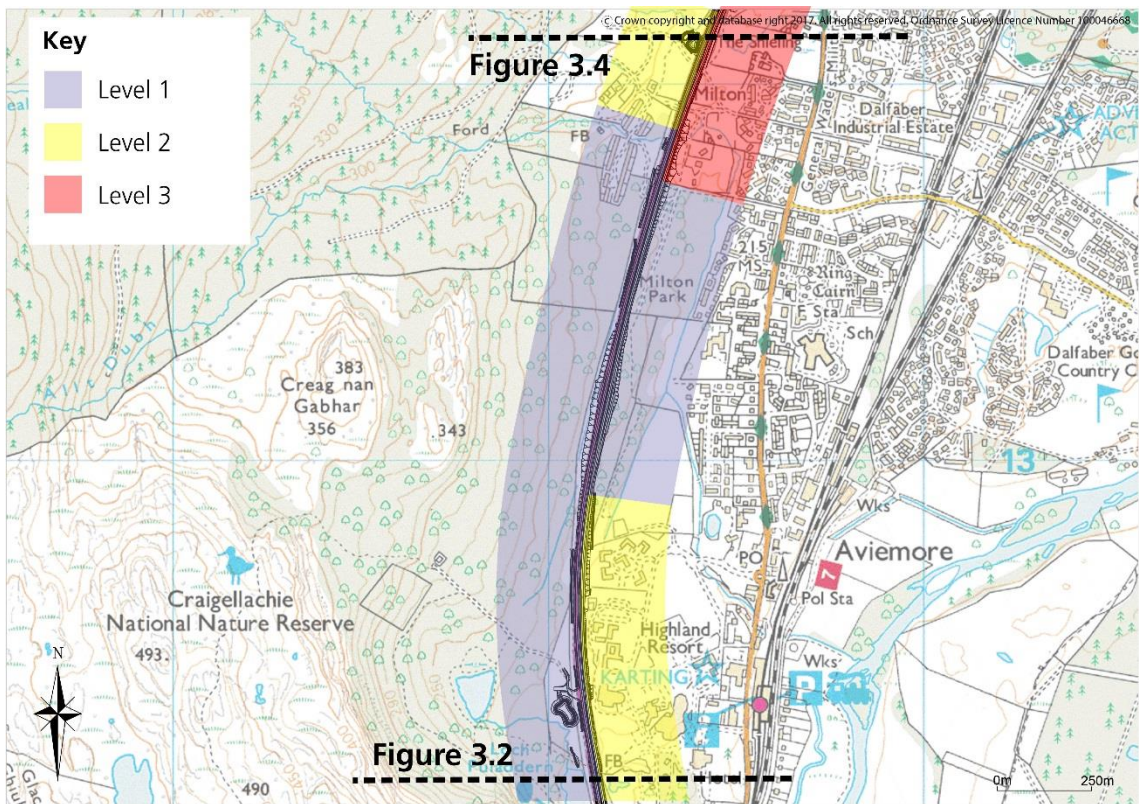


Figure 3.3: Landform Sensitivity – Ch. 5300-7300

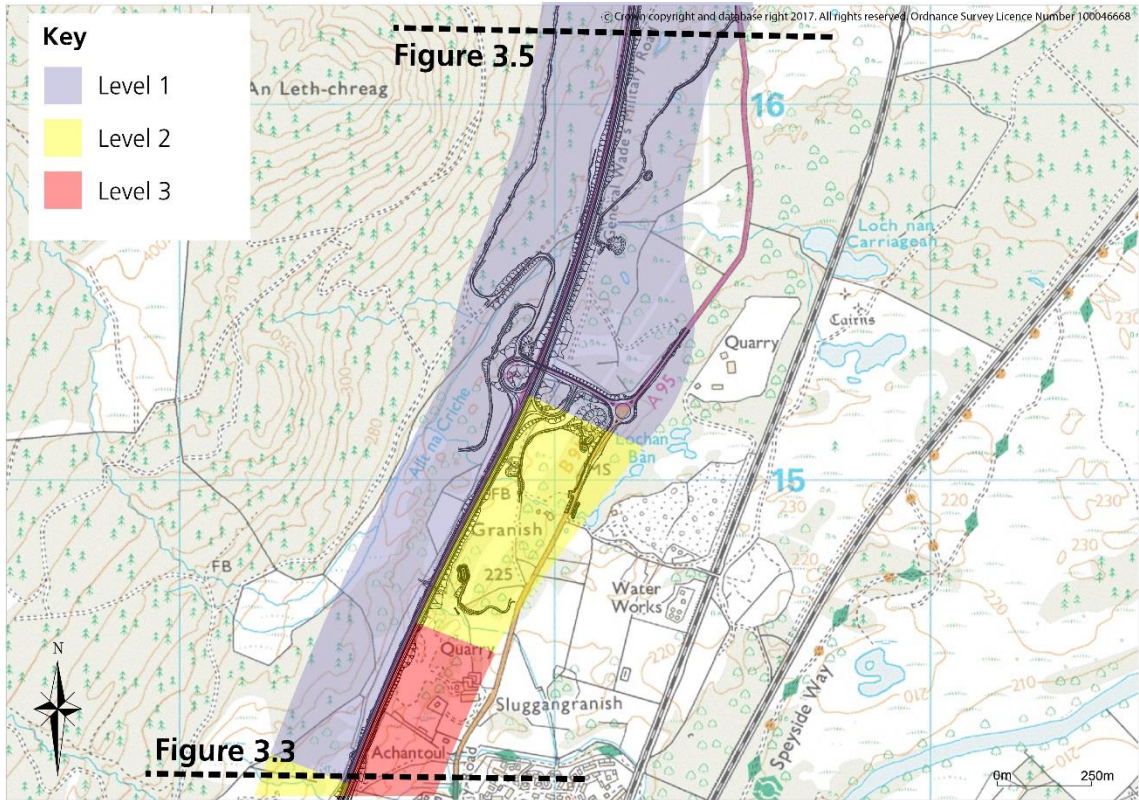


Figure 3.4: Landform Sensitivity – Ch. 7300-9700

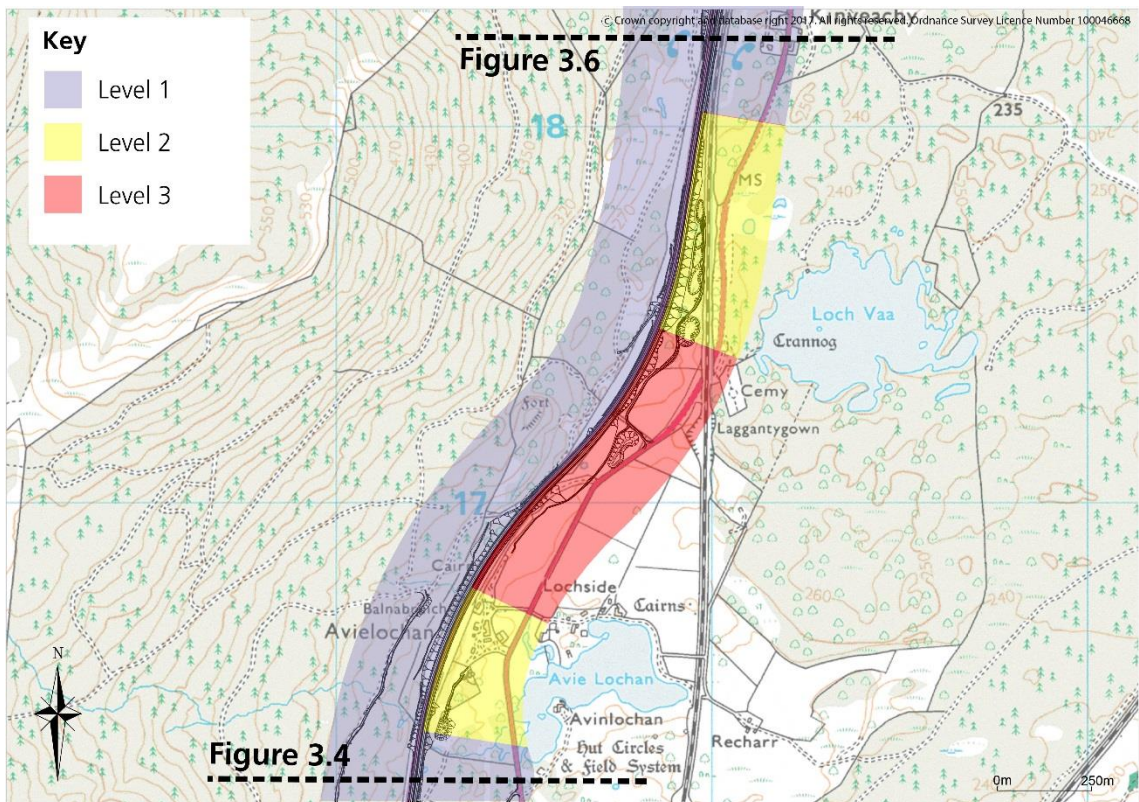


Figure 3.5: Landform Sensitivity – Ch. 9700-12000

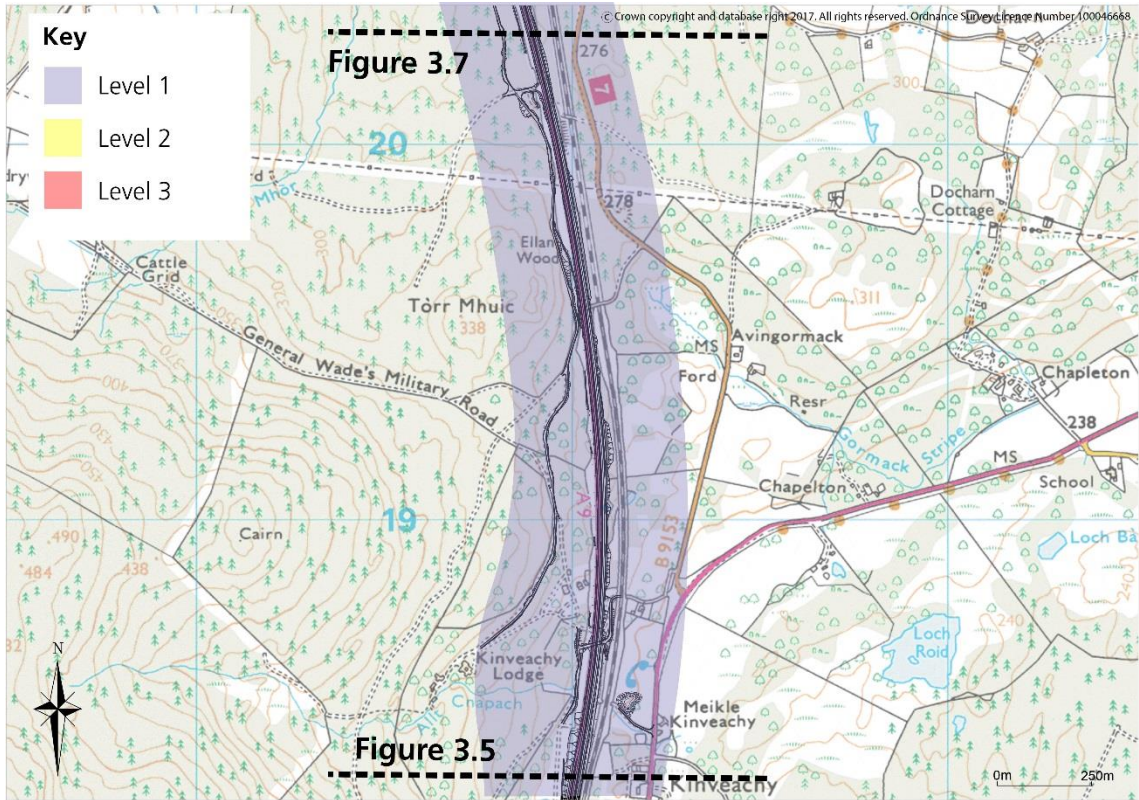


Figure 3.6: Landform Sensitivity – Ch. 12000-14000

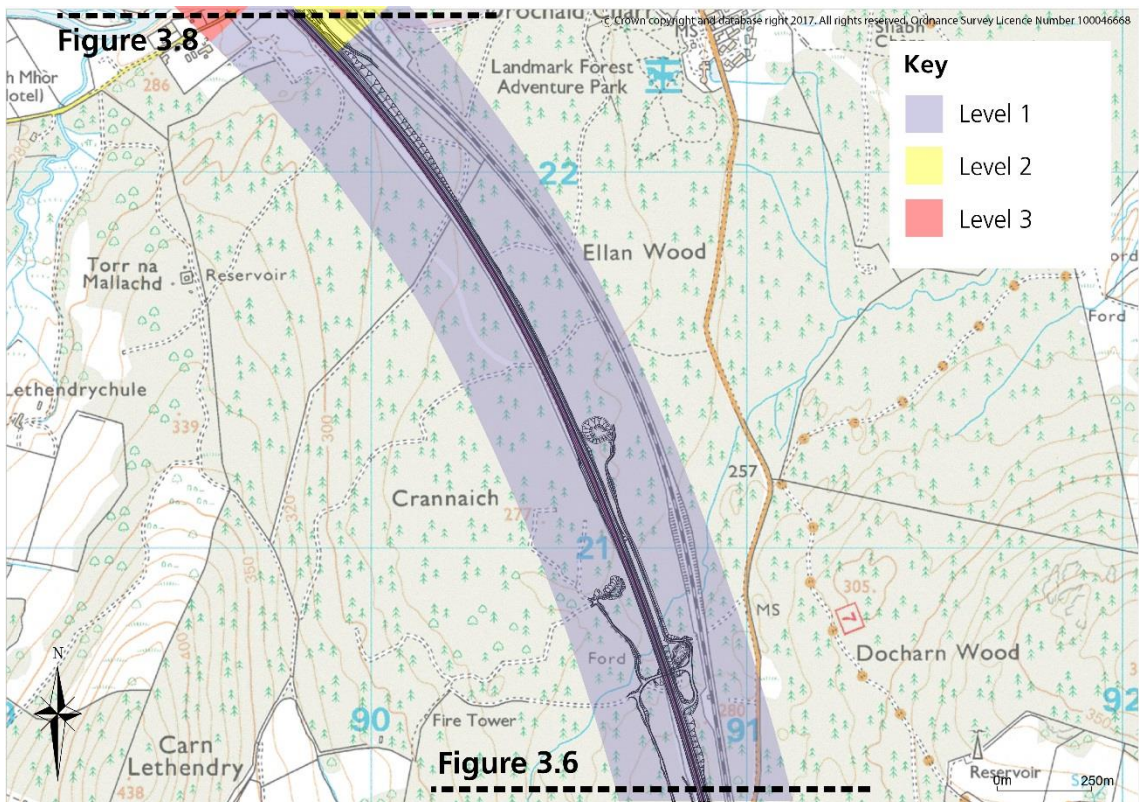


Figure 3.7: Landform Sensitivity – Ch. 14000-16400

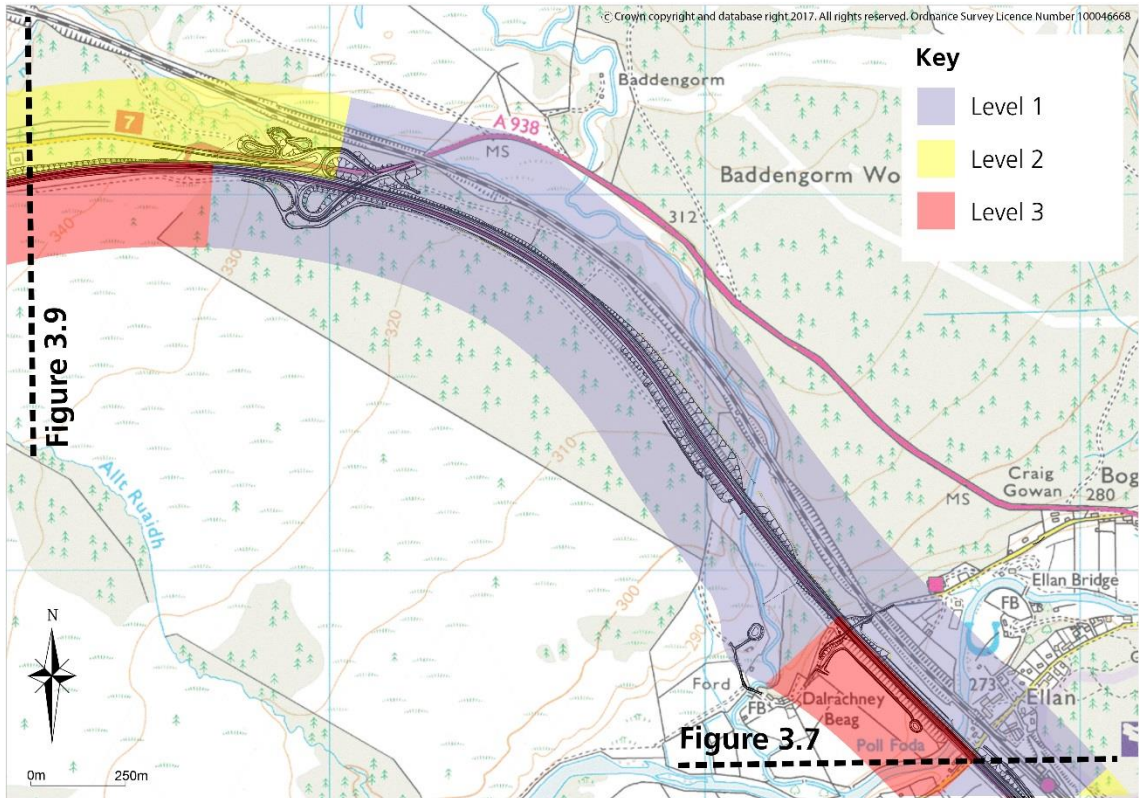


Figure 3.8: Landform Sensitivity – Ch. 16400-19500

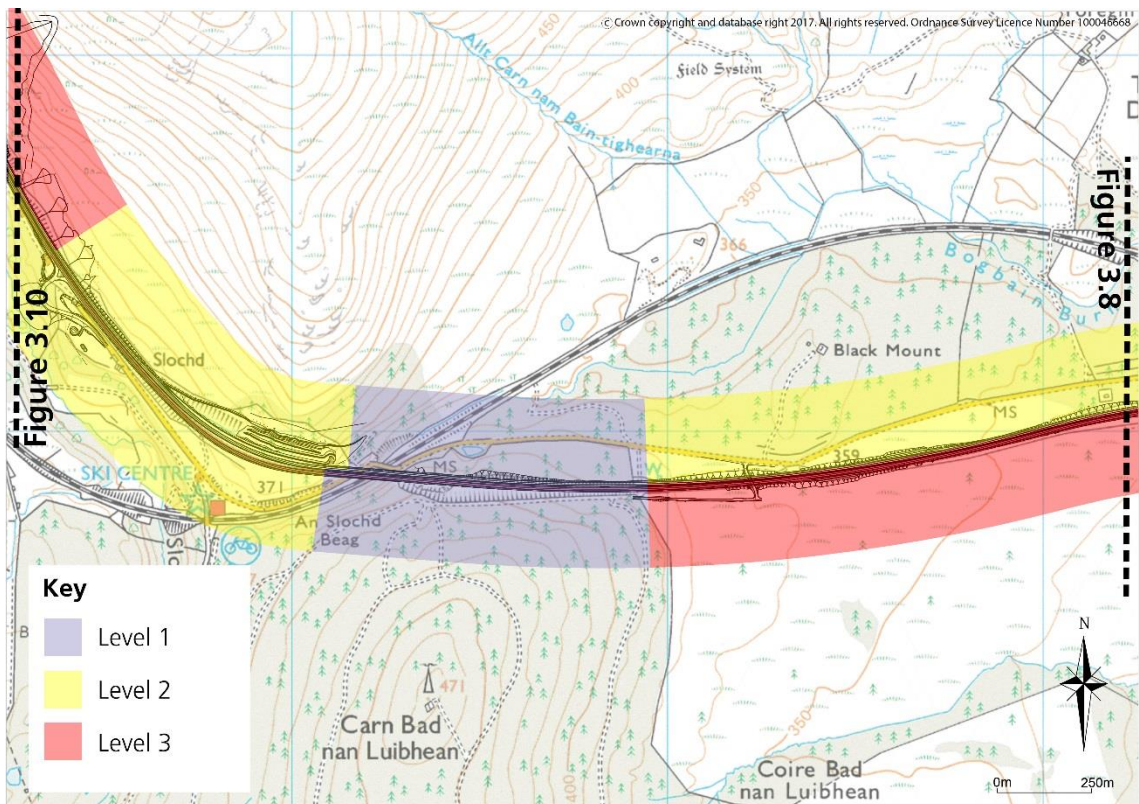


Figure 3.9: Landform Sensitivity – Ch. 19500-22800

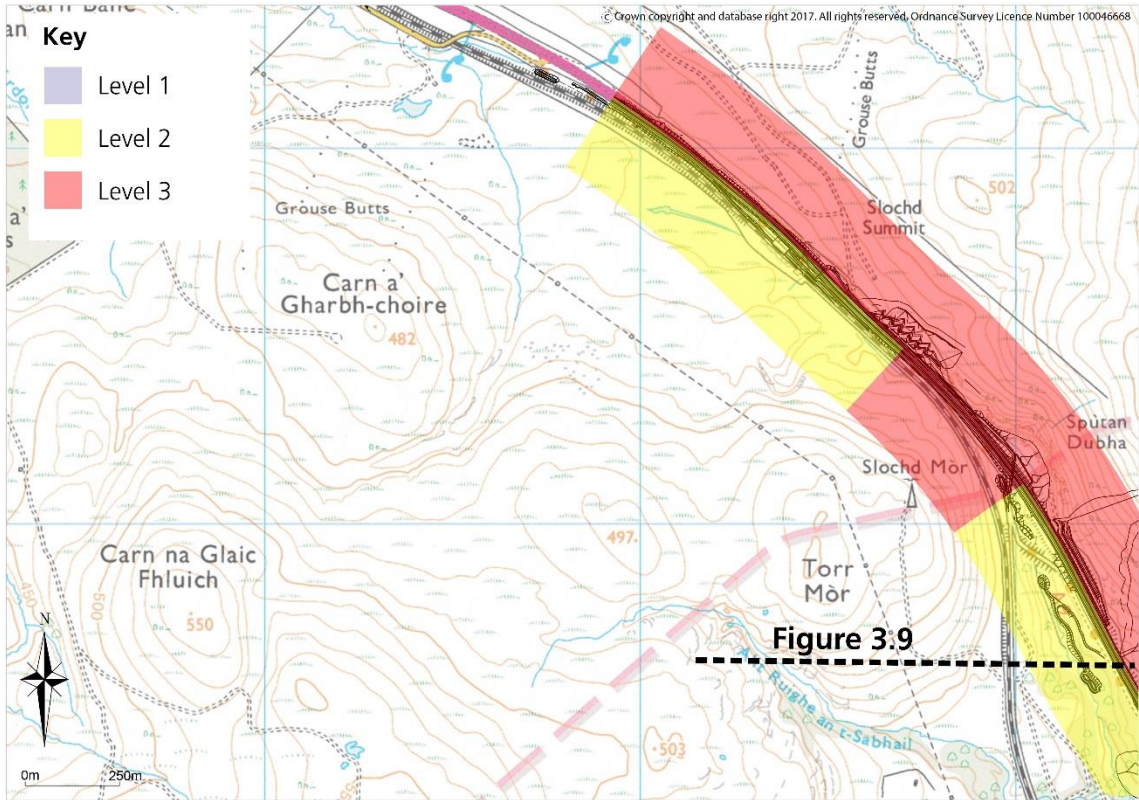


Figure 3.10: Landform Sensitivity – Ch. 22800-25250

4. Areas of Focused Earthworks Design

4.1. Location One: Chainage 5500-7000 (NB)

- 4.1.1. At this location, there is a well wooded appearance within the landscape and the A9 is confined by trees on both sides, as illustrated by Photograph 4.1. Craigellachie National Nature Reserve (NNR) is situated immediately to the west of the southernmost extent of this section and its character is extended throughout by the presence of birch woodland.
- 4.1.2. The landform sensitivity of this location is considered to be Level 1 due to the enclosed nature of the landscape and intention to plant the northbound carriageway embankment of the A9 with birch and mixed woodland.
- 4.1.3. The cutting slope adjacent to the northbound carriageway of the A9 has been steepened to a gradient of 1:2 in order to reduce the potential need for felling and maintain the wooded character of the landscape. Slope stability was identified as a constraint, therefore chainages 6100-6300 and 6600-6625 were steepened to 1:2.5, as illustrated by Figure 4.2 (located on Figure 4.1), to avoid the need for slope stabilisation measures such as soil nailing which would have an adverse impact on appearance and localised landscape character.

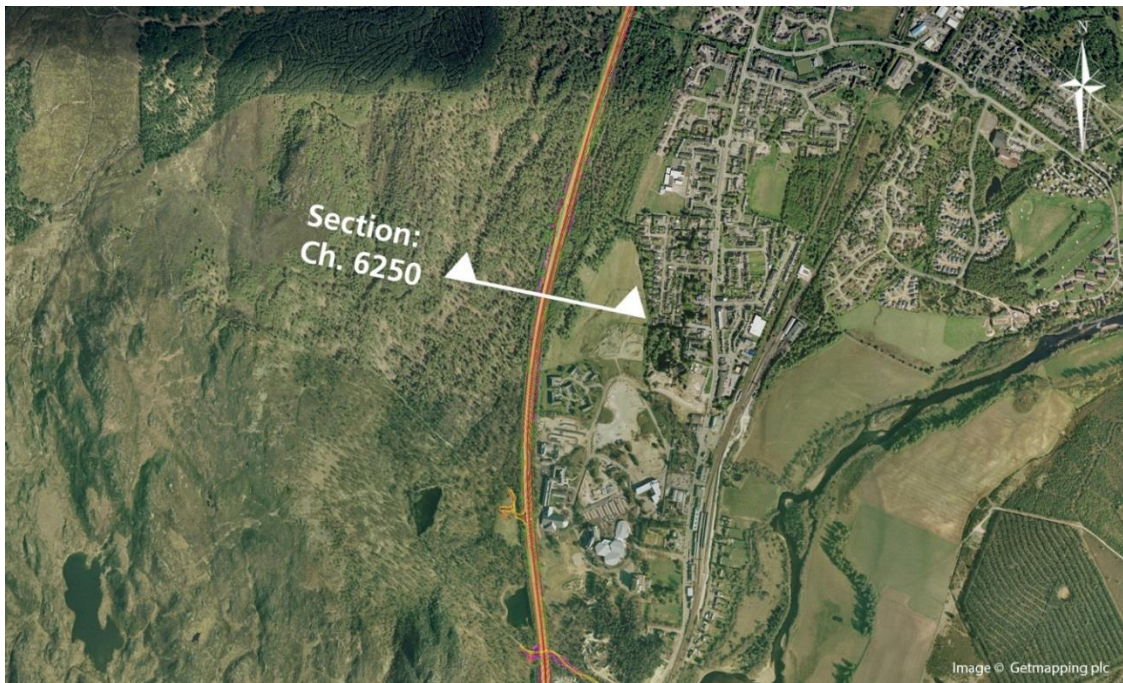


Figure 4.1: Illustrative Plan – Chainage 5500-7000



Figure 4.2: Illustrative Section – Chainage 6250



Photograph 4.1: Wooded landscape adjacent to the A9 to the north of Craigellachie NNR

4.2. Location Two: Chainage 5650-5875 (SB)

- 4.2.1. At this location, there is a well wooded appearance within the landscape and the A9 is confined by trees on both sides, as illustrated by Photograph 4.1. Adjacent to the southbound carriageway, there is a bund which contributes to the screening of views for receptors within the Macdonald resort.
- 4.2.2. The landform sensitivity at this location is considered to be Level 2 due to the close proximity of visual receptors and the degree of screening afforded by the existing earthworks. Woodland planting would integrate with the surrounding landscape and is considered to be appropriate at this location.
- 4.2.3. Interference with the existing backslope of the bund was identified as a constraint as this would result in a greater loss of existing mature trees and the potential for geotechnical complications.
- 4.2.4. As illustrated by Figure 4.4 (located on Figure 4.3), from chainage 5650 to 5675 a 0.75m bund is proposed to provide screening to visual receptors at this location within the Macdonald resort.
- 4.2.5. From chainage 5675 to 5875 it is considered that a bund could not be formed without compromising the existing backslope. Therefore, a slight cutting is proposed, as illustrated on Figure 4.5 (located on Figure 4.3) to square-off the landform and afford a degree of screening to receptors within the Macdonald resort.



Figure 4.3: Illustrative Plan – Chainage 5650-5875



Figure 4.4: Illustrative Section – Chainage 5675



Figure 4.5: Illustrative Section – Chainage 5700

4.3. Location Three: Chainage 10650-11000 (SB)

4.3.1. At this location the landscape is open with localised undulations, as illustrated by Photograph 4.2. This contrasts with the steep slopes adjacent to the northbound carriageway of the A9. The A9 is generally wooded adjacent to the northbound carriageway. There is a thin strip of trees adjacent to the southbound carriageway that would require removal to facilitate mainline widening at this point.

- 4.3.2. The landform sensitivity of this location is considered to be Level 3 because the proposed embankment will be seen by receptors using the A95 and National Cycle Network Route 7 (NCN7) in the context of the existing undulations in the field adjacent to the A9 and open, scenic views to the Cairngorm Massif to the east. Some tree planting at the top of the embankment is considered appropriate to replicate the existing character and screen views of traffic for receptors on the A95, however it would not be in alignment with the local landscape character to propose tree planting on the entirety of the embankment.
- 4.3.3. As illustrated by Figure 4.7 (located on Figure 4.6), the embankment adjacent to the southbound carriageway will be eased out to a gradient of 1:4 to integrate the Proposed Scheme into the adjacent landscape and mitigate against visual impacts for receptors on the A95 and NCN7.

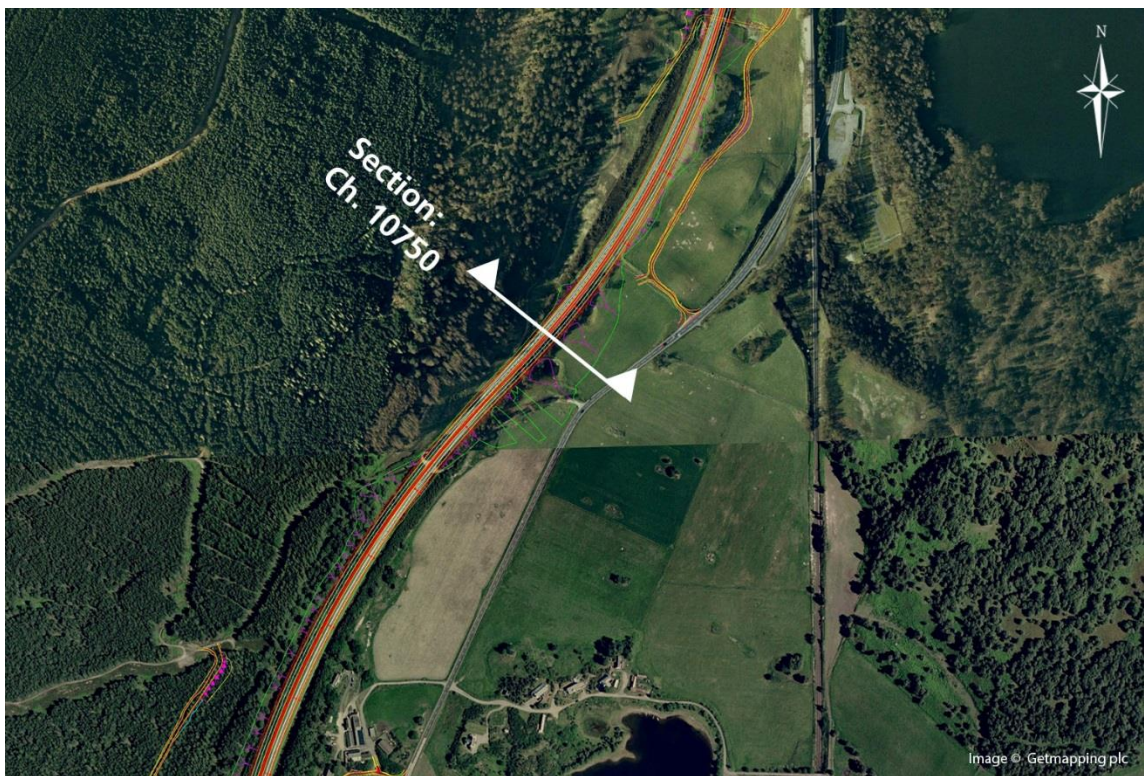


Figure 4.6: Illustrative Plan – Chainage 10650-11000

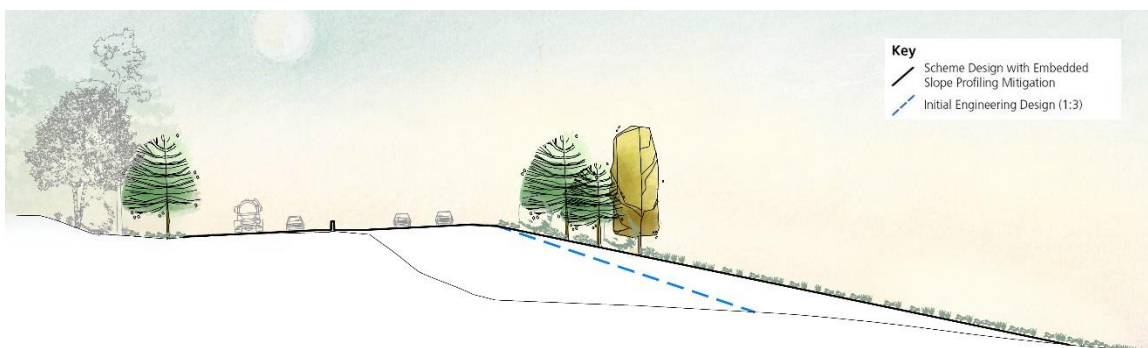


Figure 4.7: Illustrative Section – Chainage 10750



Photograph 4.2: Open undulating landscape viewed from the A95/NCN7

4.4. Location Four: Chainage 22300-23000 (SB)

- 4.4.1. At this location, the landscape is exposed and vegetation cover is primarily moorland on the hillslopes with some scrub and small trees that have regenerated. The exposed moorland hillslopes are a characteristic of the landscape and contrast with the enclosure of the gorge.
- 4.4.2. The landform sensitivity is considered to be Level 2 from chainage 22300 and 22650 as some tree planting would be consistent with the adjacent landscape, where trees have regenerated.
- 4.4.3. The landform sensitivity is considered to be Level 3 between chainage 22650 and 23000 because the open landscape character restricts the planting of trees and the slope would be viewed in the context of the wider hillslope.
- 4.4.4. The initial proposal was for a steepened slope of 1:2 to minimise the loss of Annex 1 heathland habitat on the hillside. However, geotechnical constraints resulted in a requirement for the use of soil nailing on slopes steeper than 1:3, which would be a visual detractor.
- 4.4.5. As illustrated by Figure 4.9 (located on Figure 4.8), from chainage 22300 to 22650 the cutting slope will be steepened to a gradient of 1:1 to minimise the extent of soil nailing on the hillside.
- 4.4.6. From chainage 22650 to 23000 the cutting slope will be eased out to a gradient of 1:3, as illustrated by Figure 4.10 (located on Figure 4.8) to integrate the Proposed Scheme into the adjacent landscape and mitigate against visual impacts for receptors on the A9 and NCN7 by avoiding the requirement for soil nailing.

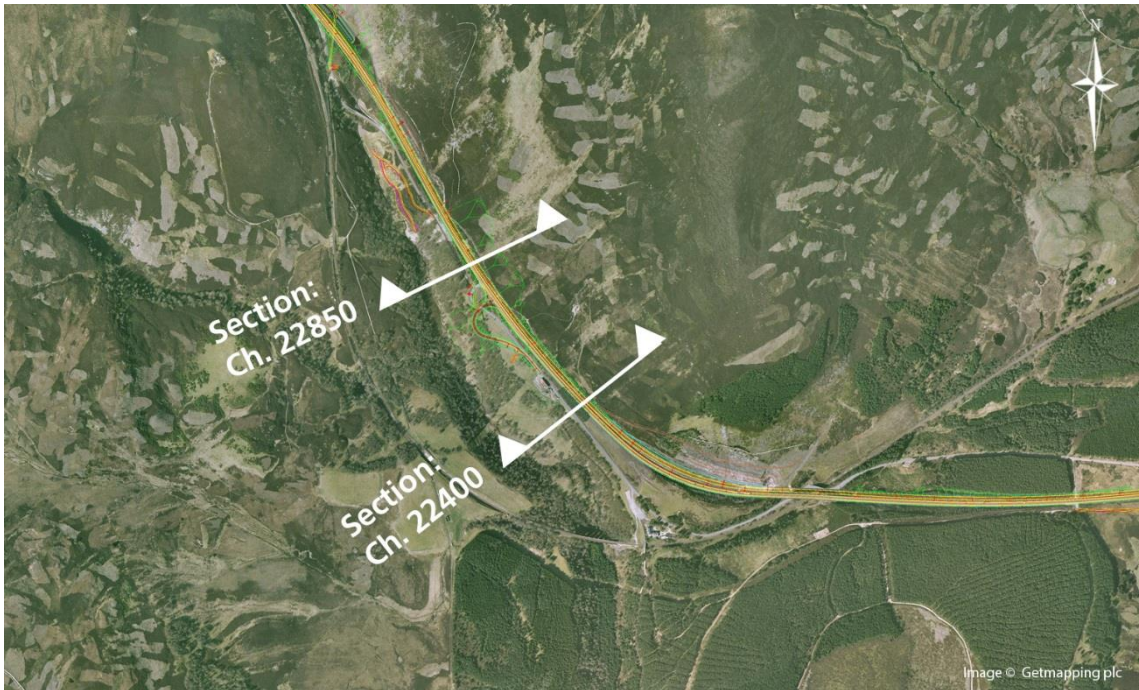


Figure 4.8: Illustrative Plan – Chainage 22300-23000



Figure 4.9: Illustrative Section – Chainage 22400



Figure 4.10: Illustrative Section – Chainage 22850

5. Summary

5.1.1. A summary of areas at which the gradient of the earthworks design has been adjusted to mitigate landscape and visual impacts as part of the iterative design process is provided in Table 5.1 below.

Table 5.1: Summary of Locations of Embedded Earthworks Mitigation

Chainage (NB/SB)	Landform Sensitivity	Proposed Gradient	Justification
5500-7000 (NB)	Level 1	1:2/1:2.5	Minimise potential loss of woodland
5650-5675 (SB)	Level 2	Provision of bund	Provide screening for visual receptors at Macdonald resort
5675-5875 (SB)	Level 2	Square-off landform	Minimise loss of screening for visual receptors at Macdonald resort
10650-11000 (SB)	Level 3	1:4	Aid integration with surrounding landform
22300-22650 (SB)	Level 2	1:1	Reduce extent of soil nailing
22650-23000 (SB)	Level 3	1:3	Aid integration with surrounding landform

5.1.2. It is recommended that within detailed design, the design of earthworks associated with the Proposed Scheme is developed to ensure opportunities to mitigate landscape and visual impacts are fully realised.

ⁱ Transport Scotland. (2014). Fitting Landscapes: Securing More Sustainable Landscapes

ⁱⁱ Highways Agency. (November 2010). Interim Advice Note 135/10 Landscape and Visual Effects Assessment.

ⁱⁱⁱ The Landscape Institute and the Institute of Environmental Management and Assessment. (2013). Guidelines for Landscape and Visual Impact Assessment.