

Transport Scotland

A82 Pulpit Rock Improvement Stage 2 Scheme Assessment Report

May 2010



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- Appendix A List of Environmental Consultees
- Appendix A1 Cultural Heritage Sites identified within the Study Area
- Appendix A2 Ecological Baseline Conditions and Relevant Legislation

1.0 Introduction

1.1 Background

The A82 trunk road between Glasgow and Fort William is the principal road link to the west of Scotland. The route is generally rural in nature between Tarbet and Fort William and consists of a single 2-lane carriageway of varying standards. The principal communities along the 108km route are Tarbet, Inveruglas, Ardlui, Crianlarich, Tyndrum, Bridge of Orchy, Glencoe, Ballachulish, Onich and Fort William.

The tortuous geometry along the section of the A82 between Tarbet and Crianlarich is well recognised and results in considerable delays to road users, particularly when a high number of tourists are attracted to the route during the summer months and when Heavy Goods Vehicles (HGVs) are required to negotiate the tight horizontal bends and narrow carriageway width. This section also includes the long-term traffic signals at Pulpit Rock where shuttle working has been in operation for many years.

This report has been prepared by Scott Wilson on behalf of Transport Scotland and investigates possible improvements to the A82 trunk road at Pulpit Rock.

A location plan showing A82 at Pulpit Rock can be seen in Figure 1.1.

1.2 Report Scope

This report summarises the development and assessment of the scheme options and the engineering, environmental, economic and traffic advantages, disadvantages and constraints associated with each scheme option, leading to the identification of a Preferred Option. The format of this report is based on that of a Stage 2 Assessment as defined in the Design Manual for Roads and Bridges (DMRB) TD37/93 "Scheme Assessment Reporting".

1.3 Project History

Following a Route Action Plan Study of the A82 between Tarbet and Fort William, the Scottish Ministers, in 2006, announced the implementation of a number of short term measures and the commencement of design work for two projects, these being a new bypass scheme at Crianlarich and removal of the traffic lights at Pulpit Rock. This latter improvement will remove the notorious bottleneck at Loch Lomond and the traffic lights which have been there for more than 20 years

In September 2006, Transport Scotland commissioned Scott Wilson to take forward the A82 Pulpit Rock Improvement Scheme.

1.4 Study Objectives

1.4.1 Scheme Objectives

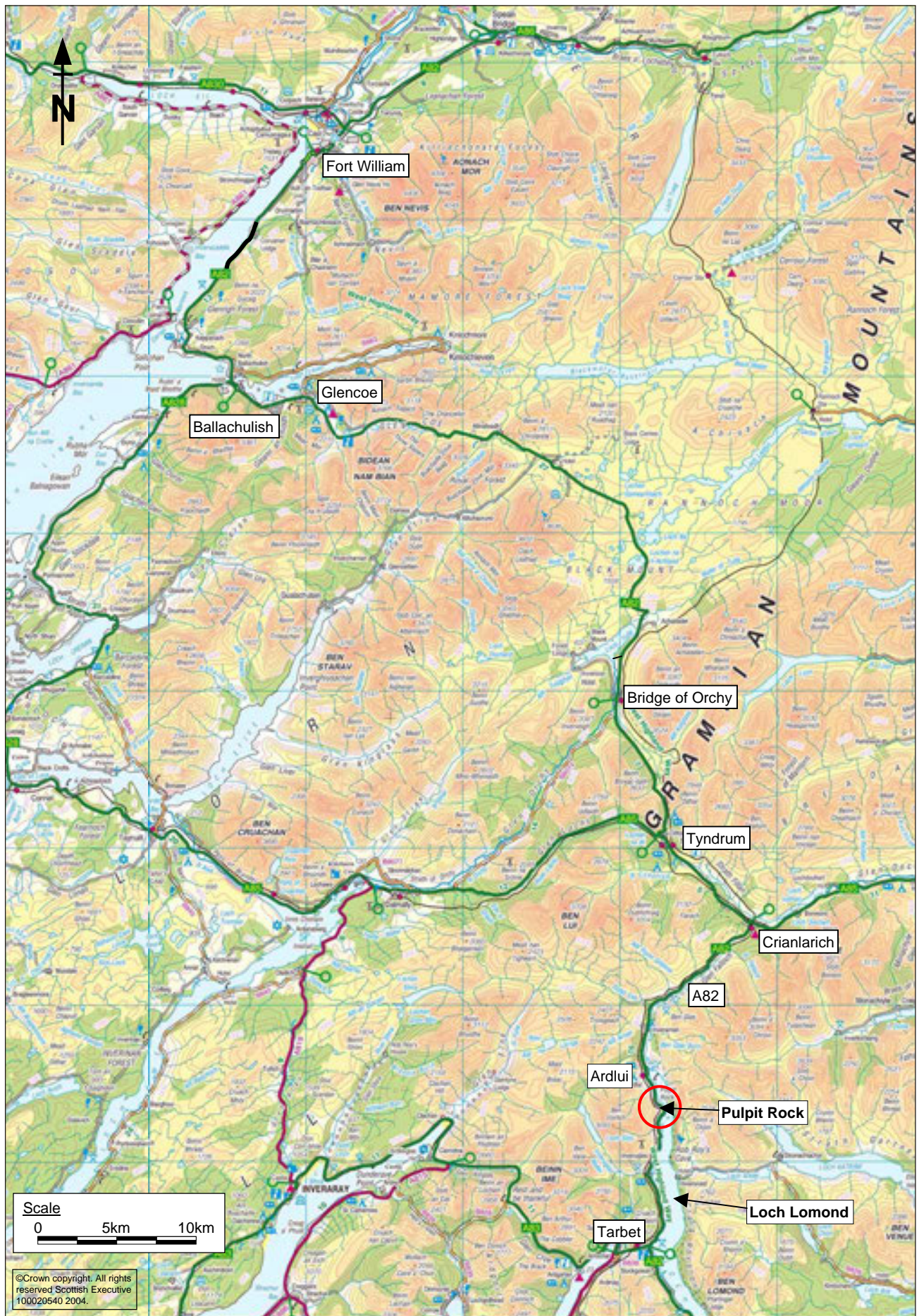
The Design of the Scheme shall be in accordance with the Government's appraisal criteria for the assessment of trunk road schemes that take account of integration, economy, safety, environmental impact and accessibility. The assessment shall satisfy the following main objectives for the project:

- Remove congestion at Pulpit Rock by realigning the A82 such that free flow of traffic is permitted without the use of the existing traffic signal controls;
- Wherever practicable incorporate measures for non-motorised users. In particular, cycling proposals shall be designed in accordance with 'Trunk Road Cycling Initiative' that supports the Sustrans Millennium National Cycle Network;
- Maintain the asset value of the A82 route;
- Mitigate the environmental impact of the new works where possible; and
- Achieve good value for money for both taxpayers and transport users.

Early on in the commission, it was evident that the primary aim of the Scheme is to remove the traffic signal controls on this trunk road route.

1.4.2 Local Objectives

Local objectives are set out in Local Authority Structure Plans and Transport Policies and Programmes. In this case, the local planning authority is the Loch Lomond and the Trossachs National Park Authority (LLTNPA). The proposals will be reviewed in consultation with the local authorities and the LLTNPA and updated as necessary to reflect current planning strategies and objectives and ensure that the proposals achieve the best "fit".



2.0 Existing Conditions

2.1 General

The study area is commonly referred to as Pulpit Rock. However, Pulpit Rock is the Scheduled Monument (SM) rock formation lying to the north of the site.



Photo 2.1 Showing Pulpit Rock

2.2 Engineering

2.2.1 Description of the existing A82

The section of the A82 under study is approximately 400m in length. The carriageway consists of 3 consecutive curves and rises from the south to a high point at the apex of the second bend and falls as the road heads north towards Ardlui.

In general, the national speed limit of 60mph applies over most of the route, except through some of the communities. Localised 40mph speed limits have also been introduced on some sections of the route for HGVs.

Photo 2.2 shows the existing study area on the A82 near Pulpit Rock. A more detailed plan view of the area can be seen in Figure 2.1 and 2.2.

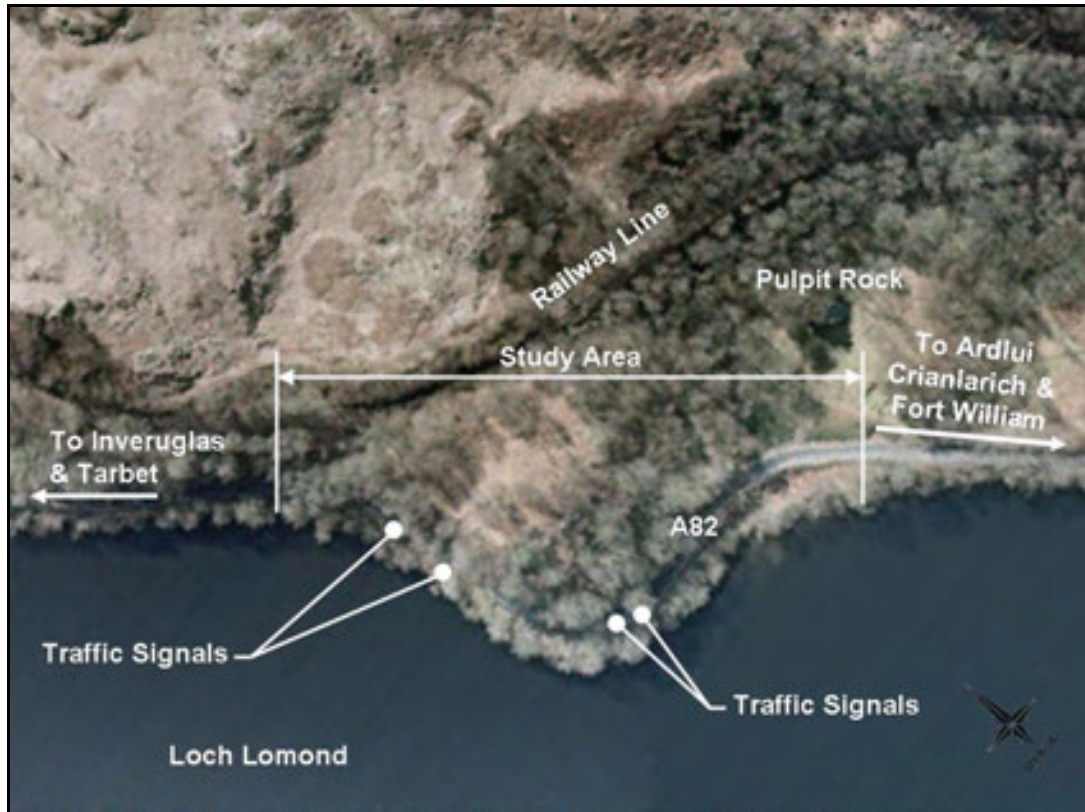


Photo 2.2: Study Area

2.2.2 Horizontal Alignment

Travelling from South to North the stretch of A82 under study starts off essentially on a straight section of road before taking three successive bends (right-left-right) of radii 100m, 50m and 80m respectively around a rock outcrop, before continuing on a notional straight towards Crianlarich in a north westerly direction. Geometry forming the bends lies well below standards applicable to this section of road. The horizontal alignment is shown on Photo 2.3.

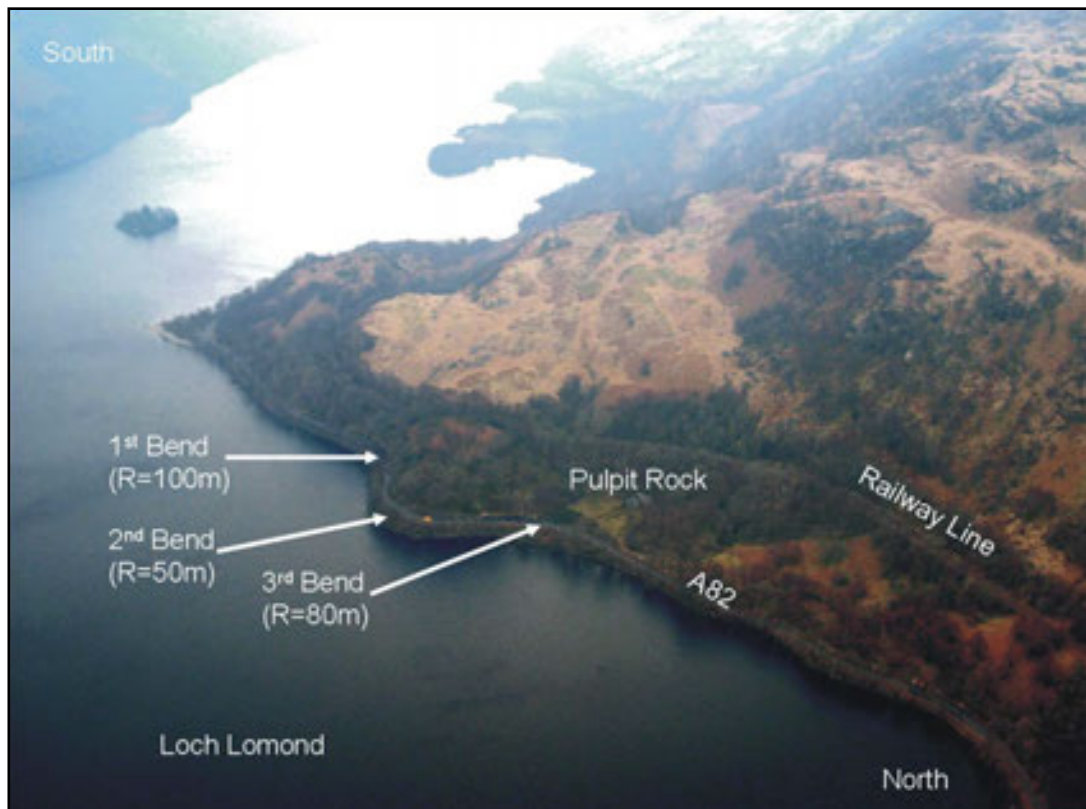


Photo 2.3: Horizontal Alignment

2.2.3 Vertical Alignment

Setting off from the South towards the North, the A82 rises with a substandard sag curve of $k=20$, followed by a substandard crest of the same value reaching its highest point at the apex of the second horizontal bend. Continuing northwards, the A82 then falls again with another sag curve of $k=20$. The vertical alignment is summarised on Photo 2.4.

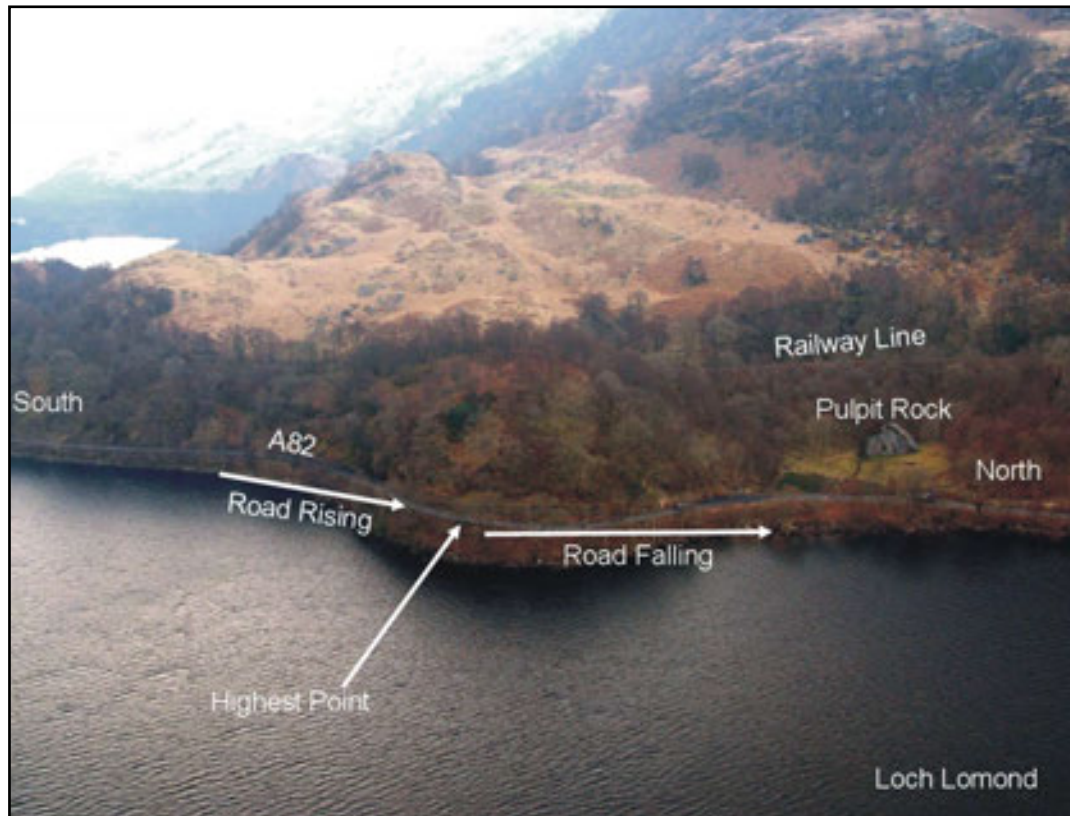


Photo 2.4: Vertical Alignment

2.2.4 Cross-Section

The existing A82 at Pulpit Rock is a single 2-lane carriageway with variable width ranging from 5.5m to 6.6m and only 3.75m through the traffic signalled section. There is no hardstrip and verge widths vary.

2.2.5 Forward Visibility

Forward visibility, travelling north along the A82 at Pulpit Rock, is at its worst at the left hand bend which is tightly bounded by rock. The minimum sight stopping distance achievable is 23m. Travelling south, a sight stopping distance of 60m can be achieved on the first and second bend.

2.2.6 Pavement – Surfacing

The surfacing along the A82 between Tarbet and Fort William, generally appears to be in good condition. The surface layers appear to be formed from a stone mastic asphalt material or similar.

2.2.7 Drainage

There appears to be no provision for positive drainage along this section of the A82. On the north bound carriageway there is no provision for any form of drainage whereas on the south bound carriageway it appears that drainage occurs through over the edge drainage towards the Loch.

2.2.8 Lay-bys

Over the Tarbet to Pulpit Rock section of the A82 lay-by provision is currently below standard. There are a total of 4 parking areas of poor standard which are merely areas of hard standing at the side of the carriageway, although it is recognised that the local topography and road geometry are such that few locations are suitable. There are also 2 designated picnic sites within this section, at Tarbet and Inveruglas, both of which are located on the southbound carriageway.

Over the Pulpit Rock to Crianlarich section of the A82 lay-by provision adheres to recommended siting distances with seven parking areas, three northbound and four southbound, although some of these lay-bys are also of a low standard.

Within the study area there is an informal stopping area (located on the outside of the right hand bend) directly opposite the Pulpit Rock Scheduled Monument. The siting of this stopping area does not adhere with desirable minimum standards as it is on a tight bend and offers poor visibility. Locally there is a formal lay-by provision some 0.6km to the north of the study area. This facility sits on the east side of the road bordering the loch. It is accessible from both directions and offers space for approximately 12 vehicles.

2.2.9 Road Lighting

There is no existing road lighting within the study area.

2.2.10 Public Utilities

Statutory Undertakers and relevant bodies have been contacted to determine their interests within the study area. Responses were received and the following indicate the apparatus within the study area.

British Telecommunications (BT)

BT has telecom services in the area along the loch side of the road (overhead).

Scotland Transerv

Scotland Transerv has apparatus associated with the traffic signals along the existing road and in some cases crossing the road (traffic signal poles, duct chambers and underground ducts).

Scottish and Southern Energy (SSE)

Scottish and Southern Energy have overhead lines that run down the hillside to the north of the study area.

Figure 2.3 shows indicative Public Utilities location.

2.2.11 Traffic

The May 2007 observed 12-hour 2-way flow is approximately 2,700 vehicles. Approximately 7% of the traffic is classified as heavy vehicles. The derived 24-hour 2-way flow is approximately 3,200 vehicles.

2.2.12 Road Safety

Dates and severities of all personal injury accidents that occurred along the Pulpit Rock section of the A82 during the ten-year period between 1997 and 2006 have been obtained.

The annual total accident figures are summarised in the following table:

Year	Fatal	Serious	Slight	Total
1997	0	0	0	0
1998	0	0	2	2
1999	0	2	0	2
2000	0	0	1	1
2001	0	0	1	1
2002	0	1	0	1
2003	0	1	1	2
2004	0	0	0	0
2005	0	1	0	1
2006	0	2	0	2
Total	0	7	5	12

Table 2.1: Accident data 1996 – 2007

Figure 2.4 shows the location and a brief description of the 12 No. recorded accidents in the immediate study area that resulted in injury.

2.3 Geotechnical

In October 2007, a Preliminary Sources Study Report (PSSR) was prepared for the scheme. This report was based on existing sources of information, comprising British Geological Survey (BGS), Macaulay Institute for Soil Research (MISR) Aberdeen, Ordnance Survey (OS), Aerial Photography and the Mineral Valuer amongst others. These sources allowed an assessment to be made of the existing geotechnical constraints and determined the objectives of a Ground Investigation along the route of the proposed options.

The following summary can be concluded from the PSSR:

The drift deposits are likely to be glacial in origin, comprising firm to very stiff sandy gravelly clay, containing cobbles and boulders and irregular bands or lenses of sand and gravel (glacial till). On land, these deposits are expected to vary between 1m and 5m in thickness, underlain by bedrock. In the loch itself, the depth of this drift is expected to range from 1m to 4m in thickness, underlain by bedrock.

The bedrock beneath the study area belongs to the Beinn Behula Schist Formation of Dalradian age and is expected to consist of metamorphosed sandstones and siltstones – quartz-mica-schists, grits and gneisses. The rocks at rockhead are expected to be very hard owing to the removal of weathered and less competent rock by glaciation.

Groundwater will not be present in the low permeability crystalline structure of the bedrock, but is expected within any natural fractures and in the crushed rock associated with faults that traverse the proposed alignments. Where there are glacial deposits overlying the rock, groundwater may collect in perched water tables, particularly where these are granular materials such as sand and gravel lenses. In the low areas underlying the slope at the northern end of the route corridor, a number of small burns are present. Such areas are likely to be poorly draining, consisting of alluvium and peat deposits with a high water table.

No contamination testing exists for the study area (prior to the current GI). However, the historical land use information indicates that contamination is likely to be limited to operations associated with agricultural use (grazing animals only), construction of the West Highland Railway, construction of the A82 Trunk Road and any degradation of existing peat deposits. Any risk of exposure associated with these sources is expected to be very low.

A Ground Investigation (GI) Contract was procured to assess the geotechnical aspects of the proposed scheme options. The GI Contract was awarded to Structural Soils Limited and the site operations were undertaken during May 2008 to July 2008.

The GI was designed to investigate drift and solid geology on the proposed options. The GI employed rotary drilling and coring, both on land and over water in Loch Lomond. In addition, percussive window sampling and in-situ penetration tests were undertaken in the soil deposits on the bed of the loch. Investigation of the soils adjacent the A82 to the North of the study area was undertaken by trial pit excavation. Existing retaining structures on the East and West verges of the A82 were investigated by horizontal rotary cores.

This report uses the information from the preliminary GI to allow assessment of the preferred option. A further GI will be undertaken on the alignment of the preferred option to target particular geotechnical design issues.

2.4 Environmental

A brief summary of the current environmental conditions is provided below. More detailed descriptions of the baseline conditions of the different environmental features can be found in Section 5.

The scheme is located in a rural location within the Loch Lomond and the Trossachs National Park. The main land use is semi-natural broad-leaved woodland, with a small area of open, rough grazing grassland at the northern end of the scheme. The road is bordered on the eastern side by Loch Lomond, one of the five largest lochs in Scotland. The main Glasgow to Fort William railway line borders the western side of the road.

Loch Lomond and the Trossachs was the first National Park to be designated in Scotland, and its close proximity to Glasgow means that it has a very high amenity value, and is particularly popular for water-related recreation e.g. sailing. The West Highland Way long distance footpath is situated on the opposite shore of the loch to the scheme. There are no



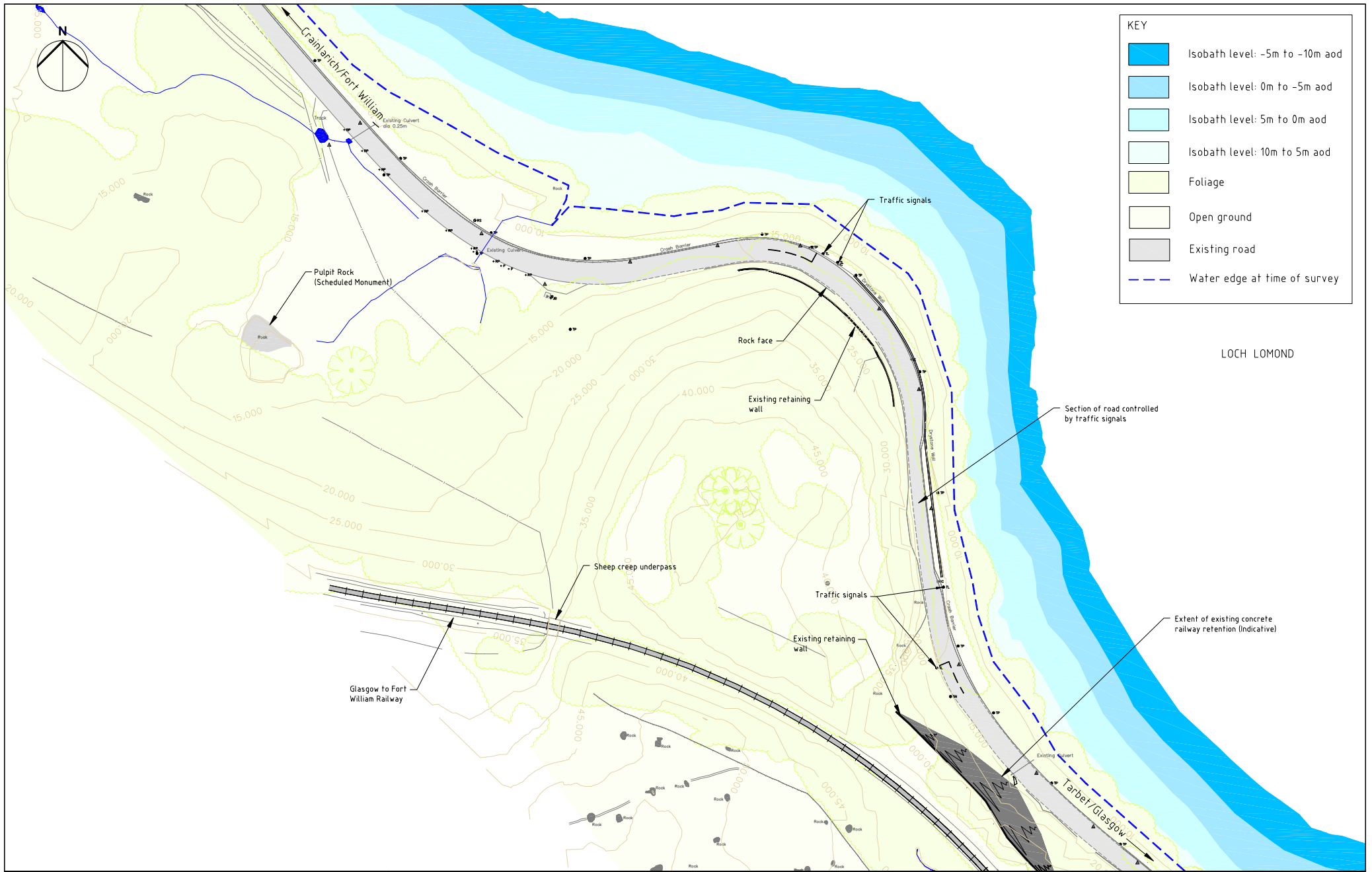
formal footpaths or cycleways along the road at this point. There is a small lay-by adjacent to Pulpit Rock.

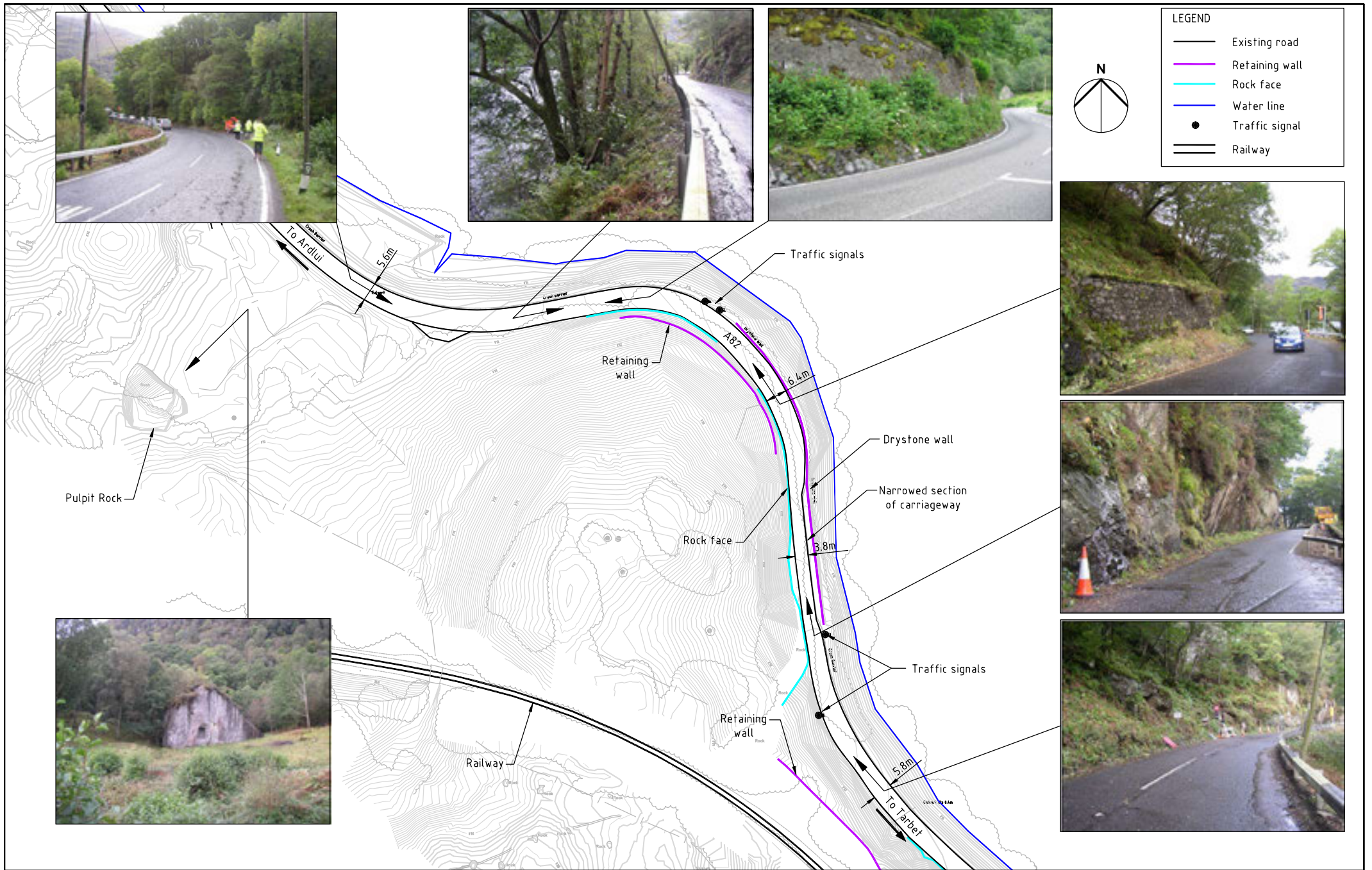
The area has also been designated as a National Scenic Area, and is of high landscape value and very sensitive to visual impacts. Notable features of the landscape include Loch Lomond itself and Pulpit Rock, a large rocky outcrop situated to the western side of the road at the northern end of the scheme. Ben Vorlich, the highest hill in Argyll and Bute, forms a backdrop to the scheme on the western side.

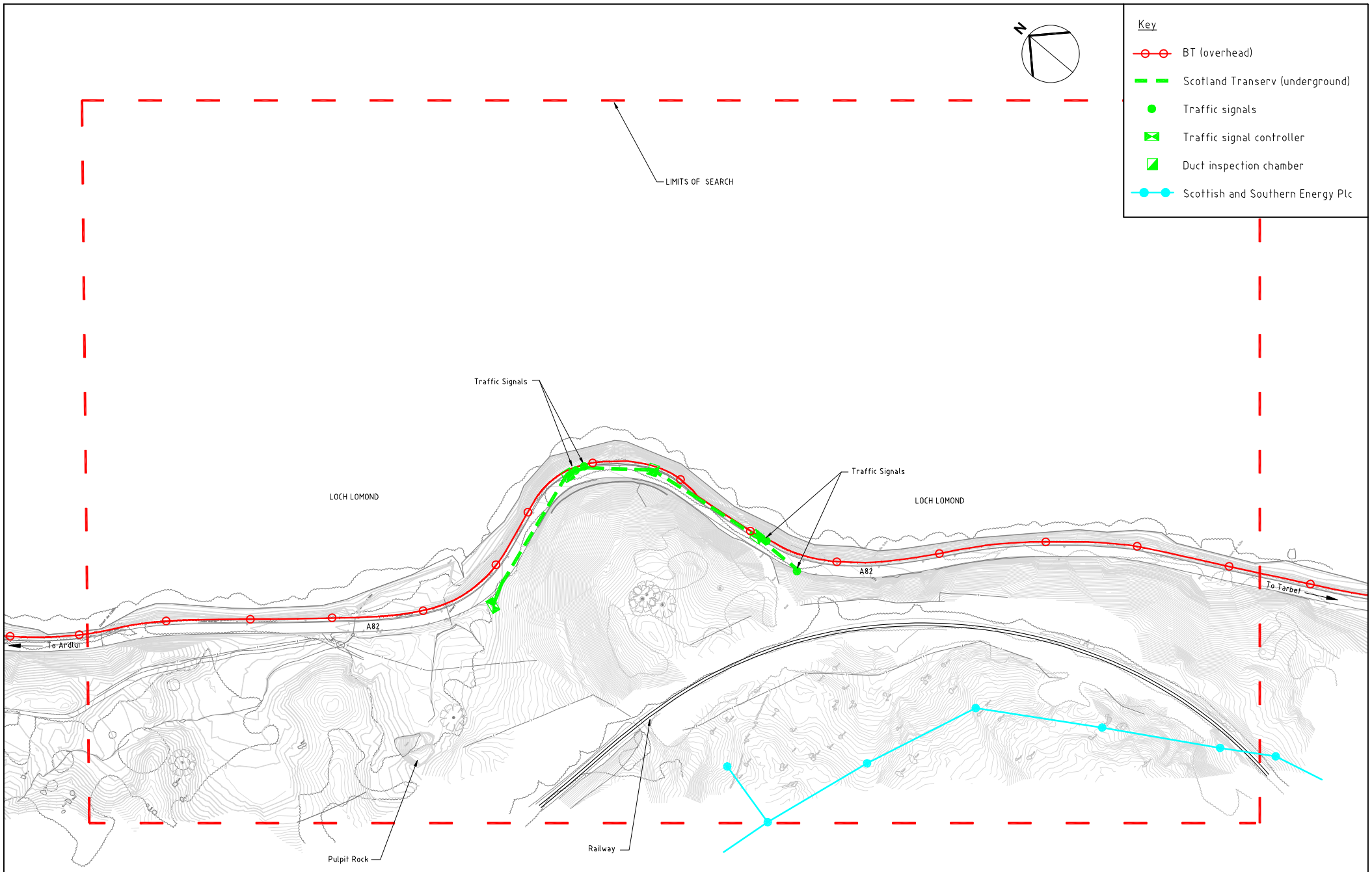
Pulpit Rock is a Scheduled Monument, which has been designated for its historic use as a preaching point and pulpit. The Tarbet to Crianlarich military road, an undesignated archaeological feature, lies within 200m of the centreline of the existing road.

In addition to Loch Lomond itself, two surface watercourses occur at the northern end of the proposed scheme. These are small and are not marked on the 1:50,000 scale maps and are culverted under the existing road. A third surface water feature is the small watercourse that flows down the steep rock slope at the southern end of the proposed scheme. This too is culverted under the road. The locations of these “unmarked” water courses and the water feature are illustrated on *Figure 5.4* within the Environmental Assessment chapter (Chapter 5). Groundwater is also present.

The principal environmental constraints are shown on Figure 2.5.



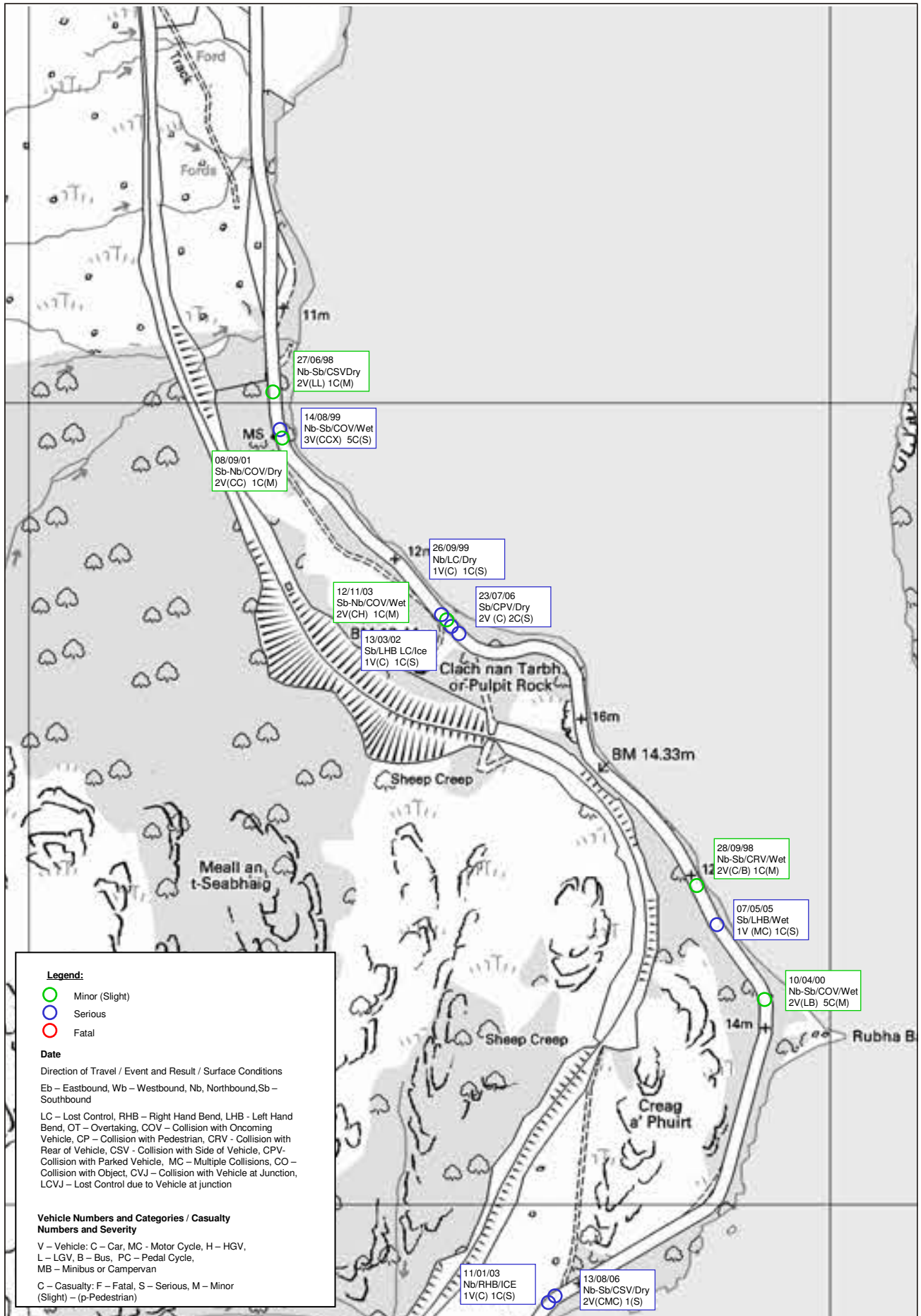


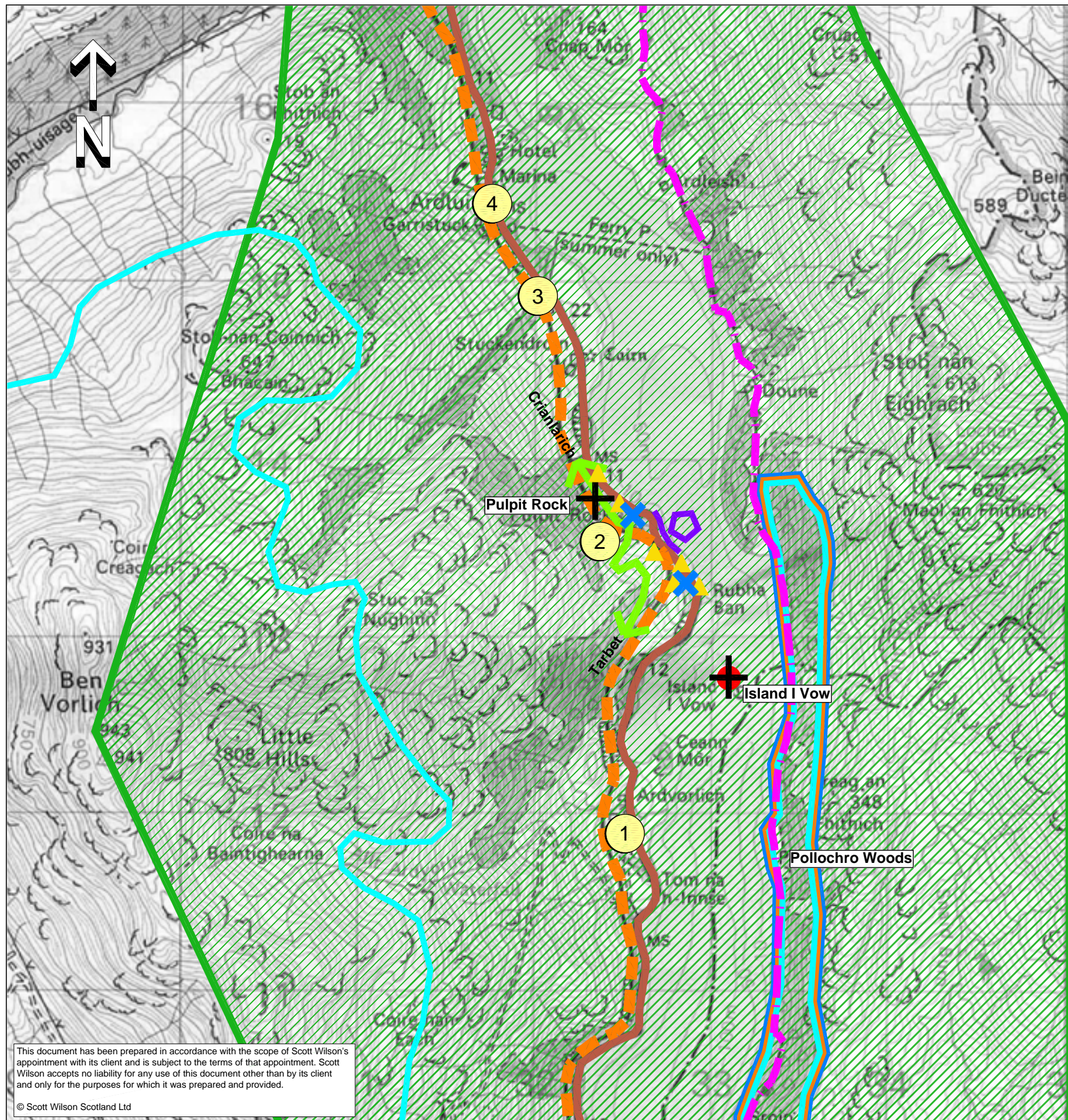


Key

- BT (overhead)
- - - Scotland Transerv (underground)
- Traffic signals
- Traffic signal controller
- Duct inspection chamber
- Scottish and Southern Energy Plc







LEGEND

- ① **Ardvorlich**
 - [REDACTED]
 - [REDACTED] (residence)
 - ② **Pulpit Rock**
 - Historic Rock
 - Cyclist controlled traffic lights
 - A82 verge side parking (c.2 cars)
 - ③ **Stuckendroin to Ardlui**
 - Residential properties (x4)
 - ④ **Ardlui**
 - Residential properties (x6)
 - Ardlui Hotel, Marina, lodges and Holiday Home Park
 - Shop (seasonal)
 - Bus stop (Ardlui Hotel)
 - Rail Station (West Highland Line)
 - Ardlui to Ardeish (Seasonal ferry)
 - Road side path sections
- National Scenic Area
 - Ancient Woodland
 - Special Area of Conservation
 - Site of Special Scientific Interest
 - Scheduled Monument
 - Listed Building
 - Glasgow - Fort William West Highland Railway
 - West Highland Way
 - A82
 - Section of Tarbet - Crianlarich Military Road [un-designated site of archaeological interest]
 - Japanese Knotweed
 - Otter Shelter/Couch Site
 - Otter Spraint/Activity
 - Tree with Bat Roost Potential

Note: The entire mapped area is situated within the Loch Lomond and the Trossachs National Park.

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3.0 Scheme Options

3.1 Background

The primary function of this report is to report on and consider options possibly forming a solution for the A82 Pulpit Rock scheme. This section of the report details the background to the scheme development and how options were selected for further assessment. It also explains the role of project workshops in supplementing the decision process.

The development of scheme options through workshops and further work and the derivation of the final options for full Stage 2 Assessment is summarised in Table 3.1. A more detailed description is presented in the following sections.

Inception Stage/Workshop June 2007			Options Workshop June 2008			Scheme Development following Options Workshop			SCHEME OPTIONS SELECTED FOR FULL STAGE 2 ASSESSMENT
During the inception period, a range of options were developed in outline. These were then assessed at the A82 Pulpit Rock Inception Workshop. The Workshop was used to introduce and involve stakeholders, confirm scheme objectives, identify risks to the scheme and to confirm which options were to be taken forward for fuller consideration during the Stage 2 Scheme Assessment process. The Workshop was held in June 2007 and full details can be found in the Workshop Report. The outcome is summarised below.			The following emerged from the Options Workshop. Workshop participants expressed a dislike for the visual effects associated with the sub-options incorporating rock fill to the loch edge. In addition results received from the site ground investigation had indicated that the loch bed was much deeper than originally considered and that the placement of such fill would be problematical. It had been thought that a submerged toe wall could be constructed to overcome this problem however the depth issue posed serious doubts over the feasibility of this proposal. Options involving significant rock cut were also considered undesirable in terms of landscape scarring and the associated visual impact. The Workshop was held in June 2008, and full details can be found in the Options Workshop Report. The outcome is summarised below.			The do-minimum option was developed further introducing a viaduct type structure built offline from the existing carriageway in order to minimise traffic disruption during the construction works. The tunnel option was developed further taking account of the ground investigation information generated from site. It was evident from the output of the June 2008 Options Workshop that the adoption of existing geometry standards was considered acceptable to Transport Scotland. Following a further site inspection it was agreed to add two further options which focused only on offering a solution to widen out the carriageway over the length of the traffic signals. These are referred to as the shortened options as summarised below.			
Option title/number	Workshop outcome	Comments	Option title/number	Workshop outcome	Comments	Option title/number	Outcome	Comments	Option Title
Option 1A – Online widening Option 1	Develop to achieve minimum design standards of 6m carriageway and 1m hardstrips	Renamed as: Do-minimum Option	Do-minimum Option	Sub option 1 (Loch edge formed by rock fill)	Not taken forward principally due to engineering and aesthetic considerations.				
				Sub option 2 (Loch edge supported by structure)	Take forward	Generally favourable with workshop attendees subject to the structural form being developed with appropriate aesthetic consideration	Do-minimum option - Sub option 2 (Loch edge supported by structure) Renamed the Viaduct option	Re-named Viaduct Option	VIADUCT OPTION
Option 1B – Online widening Option 2	Modify alignment to minimise rock cut	Renamed as: Option A	Option A	Sub option 1 (Loch edge formed by rock fill)	Not taken forward principally due to engineering and aesthetic considerations.	Shortened Do-minimum (Structure) Option New option comprising short section of viaduct sited offline from the existing road.	Agreement to develop further ensuring that sections of the existing carriageway lying to the immediate north of the traffic lights can accommodate two-way traffic. No particular preference between either of the shortened options.	Re-named Shortened Option (Viaduct)	SHORTENED OPTION (VIADUCT)
				Sub option 2 (Loch edge supported by structure)	Scored poorly because of the aesthetics associated with the rock cut and not taken forward.			Shortened Do-minimum (Retaining Wall) Option New option formed by widening the existing road and supported using a new retaining structure.	Re-named Shortened Option (Retaining Structure)
Option 2A – 100m Radii Option 1	Develop to minimise the rock cut	Renamed as: Option B	Option B	Sub option 1 (Loch edge formed by rock fill)	Not taken forward principally due to engineering and aesthetic considerations. Also scored poorly because of the aesthetics associated with the rock cut.				
				Sub option 2 (Loch edge supported by structure)	Scored poorly because of the aesthetics associated with the rock cut and not taken forward				
Option 2B – 100m Radii Option 2	Dropped								
Option 3 – 510m Radii	Dropped								
Option 4 – Tunnel	Retained	Renamed as: Option C	Option C	Tunnel	Take forward	Option C	Option C - Tunnel	Re-named Tunnel Option	TUNNEL OPTION

Table 3.1 – Scheme options development summary

3.2 Inception Stage/Workshop

3.2.1 Background

The initial period of the commission was used to collect readily available data and to identify a range of options which could possibly form a solution for the A82 Pulpit Rock scheme. As well as this it is standard practice that an Inception Workshop is held at the start of each stage of reporting. There can be various reasons why a workshop can be very useful. For the A82 Pulpit Rock project the workshop was used to introduce and involve stakeholders, confirm scheme objectives, identify risks to the scheme and to confirm which options required to be taken forward for fuller consideration during the Stage 2 Scheme Assessment process.

3.2.2 Options Considered

In advance of the workshop a number of preliminary scheme options were developed for consideration. With some earlier work such as the A82 Route Action Plan possibly suggesting that a tunnel option presented the most obvious solution for Pulpit Rock, it was felt necessary to take a fresh look at what could be achieved. Therefore, following initial discussion, a series of options were drawn up for consideration at the workshop. These were:

- **Option 1A:** Online Widening – 6m carriageway with no hard strips, widened on tight radii curves in accordance with the DMRB. Nominal 0.5m verges, widened where required for road restraint system provision on the loch side, but not widened for visibility.
- **Option 1B:** Online Widening – 6m carriageway with no hard strips, widened on tight radii curves in accordance with the DMRB. 2.5m verges, widened for visibility associated with a 70kph Design Speed.
- **Option 2A:** 100m radii Option 1 – 100m radii back-to-back curves, cutting through existing rock outcrop at the apex of the alignment. 6m carriageway with 1m hardstrips widened on tight radii curves in accordance with the DMRB. 2.5m verges, widened for visibility associated with a 70kph Design Speed.
- **Option 2B:** 100m radii Option 2 – 100m radii back-to-back curves, aligned to omit cutting through the existing rock outcrop at the apex of the alignment. 6m carriageway with 1m hardstrips widened on tight radii curves in accordance with the DMRB. 2.5m verges, widened for visibility associated with a 70kph Design Speed.
- **Option 3:** 85kph – 510m radii curves associated with 85kph Design Speed from the DMRB. 6m carriageway with 1m hardstrips, no widening required. 2.5m verges, widened for visibility associated with a 70kph Design Speed.
- **Option 4:** Tunnel – Straight alignment cutting through existing rock. 6m carriageway with 1m hardstrips. 2.5m verges outwith the tunnel and minimum 1m verges within.

There were countless further iterations which could have been developed however the above group were considered to form a representative and diverse sample ranging from options based on online widening to those offering significant alignment improvement.

3.2.3 Inception Workshop Conclusions

The above options were presented at the Inception Workshop, held in June 2007. Full details of the options presented and the outcomes are provided in the Inception Workshop Report. Table 3.2 gives an overview of what was agreed with regards to taking forward scheme options.

Preliminary Option	Comments	New Scheme Option Name
Option 1A	Develop to achieve minimum design standards of 6m carriageway and 1m hardstrips.	Do-Minimum Option
Option 1B	Modify alignment to minimise rock cut	Option A
Option 2A	Develop to minimise encroachment into the rock cut	Option B
Option 2B	Dropped	-
Option 3	Dropped	-
Option 4	Keep as is	Option C

Table 3.2: Workshop outcome regarding Scheme Options

In addition to the above, it was decided that some form of support structure solution might provide an alternative to the rock in-fill proposed in the above options. It was agreed therefore that support structure alternatives should be prepared for each option for further consideration during the Stage 2 Assessment.

3.3 Initial Development/Assessment and Options Workshop

3.3.1 Options taken forward

For clarity, the options brought forward from the Inception Workshop were renamed with sequential alphanumeric references, incorporating sub-options to represent either the rock infill or support structure alternatives as follows:

- Do-min** **On-line widening**
Sub option 1 – loch edge formed from rock fill
Sub option 2 – loch edge supported by structure
- Option A** **On-line widening with improved verges**
Sub option 1 – loch edge formed from rock fill
Sub option 2 – loch edge supported by structure
- Option B** **Improved highway alignment - 100 metres radius**
Sub option 1 – loch edge formed from rock fill
Sub option 2 – loch edge supported by structure
- Option C** **Tunnel**

3.3.2 Development and Assessment

All options met the main criteria of providing two way traffic and removing the traffic signals. It was recognised that it would be difficult to achieve required standards in terms of geometry and forward visibility for most layouts however through discussion with Transport Scotland an appropriate design speed was agreed and used for assessment purposes.

Consequently, the options brought forward were further developed for full stage 2 assessment in accordance with the requirement the Design Manual for Roads and Bridges TD 37/93 – Scheme Assessment Reporting.

3.3.3 Options Workshop

Although the assessment process was not fully complete at this stage enough information had been gathered to move onto an options workshop. Therefore in June 2008 an Options Workshop was held.

In most cases it is intended that an Options Workshop would supplement the Stage 2 decision process rather than establishing the outcome. However, in this case the workshop proved to be very informative and some very clear views, particularly from stakeholders, emerged which significantly influenced events.

Two preferred options emerged from the workshop findings:

Do-min Option C	Sub option 2 - loch edge supported by structure Tunnel
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Full details are presented in the Options Workshop Report, however, in summary, there were two main issues arising from the workshop which influenced the outcome.

Workshop participants expressed a dislike for the visual effects associated with the sub-options incorporating rock fill to the loch edge. In addition, results received from the site ground investigation had indicated that the loch bed depth was much deeper than originally considered and that the placement of such fill would be problematical. It had been thought that a submerged toe wall could be constructed to overcome this problem; however the depth issue posed serious doubts over the feasibility of this proposal.

Options involving significant rock cut were also considered undesirable, in particular in terms of landscape scarring and the associated visual impact. The implications of this were that options A and B did not score as favourably as the do-minimum options.

Whilst many other issues were also discussed at length, the above two issues were key to influencing which options emerged for further consideration.

3.4 Further Scheme Development

3.4.1 Background

Following the Options Workshop, there were concerns in regard to the financial and operational implications of emerging options. As a result, prior to finalising the preferred option, senior management advice was sought on operational and financial constraints that should be placed on the scheme as part of the route selection process.

3.4.2 Development and Assessment of shortened alternatives

The development of the options following the Options Workshop concentrated on further detailing of the Do-minimum Structure and the Tunnel options. This was necessary in order to have a better understanding of the buildability issues and the influence this would have on traffic management and construction costs.

It was realised that the cost and scope of both options was considerably more than originally defined in the scheme brief. The Do-minimum Structure option in particular had been developed to meet the aspiration of stakeholders as presented at the Options Workshop and this was a significant factor in the increase in costs. The Tunnel option, due to technical difficulties associated with problematical ground conditions, was also much more expensive than originally envisaged.

At the same time, it was evident that the adoption of existing geometry standards was considered acceptable to Transport Scotland. Following a further site inspection, it was agreed to add two further options which focused on the carriageway over the length of the traffic signals.

Consequently, two alternatives which consider the merits of a shortened scheme, have also been developed:

Shortened do-minimum (structure) option

Shortened do-minimum (retaining wall) option

Both alternatives focus on the length of carriageway currently operating under traffic signal control. The first option would be constructed using a viaduct layout similar to the full do-minimum structure option. This would be applied over a length of approximately 180 metres. The second option would be constructed using embedded steel sheet piled retaining structure over a length of approximately 100m. A wall type construction was discussed at the Options Workshop and generally ruled out due to concerns about aesthetics, however this option proposes the wall over a shorter length and possibly it would be considered acceptable where the overall scale of works is less.

Due to the introduction of the shortened options and for clarity, it was decided that the scheme options should be renamed as follows.

Previous Scheme Option Title	New Scheme Option Title/Additional Option
Do-minimum Option	Viaduct Option
Option C	Tunnel Option
Shortened Do-minimum (Structure) Option	Shortened Option (Viaduct)
Shortened Do-minimum (Retaining wall) Option	Shortened Option (Retaining Structure)

3.4.3 Development and Assessment of other options

It was also agreed that further consideration was required on the detail of the Viaduct and Tunnel options as detailed below.

Viaduct Option

Significant interest had been expressed regarding the appearance of any structure supporting the new road. There was also interest in gaining more knowledge of the buildability issues associated with all aspects of the construction and in particular those requiring any closures of the road.

This option originally considered a full viaduct for the improvements but it was agreed that the viaduct should be altered by replacing the northernmost spans with an earth embankment. It was apparent that there could be cost savings and traffic management benefits attached to this design.

Tunnel Option

There was interest in the visual aspect associated with the retaining structures required on the south lead up to the tunnel entrance. Similarly, there was also interest in gaining more knowledge of the buildability issues associated with all aspects of the tunnel construction and in particular those requiring any closures of the road.

3.5 Options for Stage 2 Assessment

3.5.1 Options taken forward for full assessment

As a result of the Options Workshop, further option development and discussion with senior management at Transport Scotland, it was agreed that four options should be taken forward for full Stage 2 Assessment. The four options are as described below.

3.5.2 Viaduct Option

The Viaduct Option provides a mainly offline structural solution with an overall length of approximately 390m. The Viaduct structure extends for approximately 300m with an online embankment solution at the north end of the scheme for a further 60m. Resurfacing works will be carried out at the start and end of the design covering 30m.

The horizontal geometry consists of 4 successive bends (right-left-right-right) of 150m, 55m, 80m and 1380m radii.

The Viaduct Option is illustrated in Figure 3.1

3.5.3 Tunnel Option

The Tunnel Option extends over a length of 340m with the central section consisting of a 150m long tunnel. Resurfacing works will be carried out at the start and end of the design covering 85m.

The A82 is widened to provide a 6m carriageway with 1m hardstrips. 2.5m verges are provided, except through the tunnel where these are reduced to 1m.

The horizontal geometry is improved to provide a single straight, through a tunnel, to replace the existing 3 consecutive bends.

The Tunnel Option is illustrated in Figure 3.2

3.5.4 Shortened Option (Viaduct)

This option provides improvements over a length of approximately 380m. The Shortened Option (Viaduct) is a partly offline structural solution which runs in parallel to the loch shoreline for approximately 180m. North of the new viaduct the existing carriageway is widened by cutting into the existing rock headland. A steep rock cutting of 80 degrees has been assumed and will require to be retained by engineering measures. An alternative shallower rock cut of 65 degrees was considered but not taken forward for further consideration due to additional cut extent requirements, and access and maintenance issues. The improvements to the existing road will extend 180m to the north of the new structure. Resurfacing works will be carried out at the start and end of the design covering 20m.

The Shortened Option (Viaduct) horizontal geometry consists of 4 successive bends (right-left-left-right) of 107m, 95m, 50m and 70m radii

The Shortened Option (Viaduct) is illustrated in Figure 3.3.

3.5.5 Shortened Option (Retaining Structure)

This option provides improvements along the A82 for approximately 385m. The Shortened Option (Retaining Structure) provides an online structural solution over a length of approximately 170m. It is proposed to reinforce the existing shore profile by installing a new backfilled retaining wall along the current narrowed section of road, thus reinstating two-way traffic. North of the new retaining wall structure the existing carriageway is widened by cutting into the existing rock headland. A steep rock cutting of 80 degrees has been assumed and will require to be retained by engineering measures. An alternative shallower rock cut of 65 degrees was considered but not taken forward for further consideration due to additional cut extent requirements, and access and maintenance issues. The improvements to the existing road will extend 190m to the north of the new structure. Resurfacing works will be carried out at the start and end of the design covering 25m.

The horizontal geometry for the Shortened Option (Retaining Structure) will be formed of similar elements to those listed for the Shortened Option (Viaduct).

The Shortened Option (Retaining Structure) is illustrated in Figure 3.4

3.6 Cost Estimates

3.6.1 Cost Estimates

Cost Estimates have been produced for all options using rates from a combination of recognised reference material, price databases and previous experience on similar schemes. All rates from all sources were reviewed to provide the most appropriate for use on this project.

All costs are presented as current to the fourth quarter of 2008. Cost estimates for the four options are shown in tables 3.1, 3.2, 3.3 and 3.4.

Scheme Cost Estimate			
A82 Pulpit Rock		Viaduct Option	
Item description	Estimate	Totals	Notes
Preparation:			
		£ 650,000	Figures all at Q4 2008 9% of Construction & Land
Supervision:			
		£ 361,000	5% of Construction & Land
Construction Cost:			
Preliminaries (incl. Traffic Management)			
	£ 1,444,000		25% of Construction
100 Prelims	£ 1,444,000		
Roadworks General			
	£ 148,000		Includes 20% for Contingencies
200 Site Clearance	£ 11,000		
300 Fencing	£ 3,000		
400 Road Restraint Systems	£ 16,000		
600 Earthworks	£ 93,000		
Main Carriageway/Side Roads			
	£ 89,000		Includes 20% for Contingencies
500 Drainage	£ 24,000		
700 Pavement	£ 50,000		
1100 Kerbs and Footways	£ -		
Signs, lighting etc			
	£ 2,000		Includes 20% for Contingencies
1200 Traffic Signs and Road Markings	£ 2,000		
Structures			
	£ 5,211,000		Includes 20% for Contingencies
1600 Piling & Embedded Retaining Walls	£ -		
1700 Structural Concrete	£ -		
2000 Waterproofing for Structures	£ -		included under Series: 2500 (Viaduct)
2500 Special Structures (Viaduct)	£ 4,342,100		Viaduct Structure
Landscape and Ecology			
	£ 56,000		1% of Construction
3000 Landscape and Ecology	£ 56,000		
Accommodation Works			
	£ 168,000		3% of Construction
Works for SUs	£ 100,000		£100K assumed to be adequate
Construction Cost total (ex VAT)		£ 7,218,000	
Land			
		£ 5,000	No VAT on Land (assumed £10,000/ha)
Optimism Bias			
		£ 2,058,500	25% of Total Cost
Other costs (if applicable)			
		£ -	
Total VAT (if applicable)			
		£ 1,391,000	15% VAT on Works
Total scheme cost (inc VAT)		£ 11,684,000	

Table 3.1: Cost Estimate – Viaduct Option

Scheme Cost Estimate			
A82 Pulpit Rock		Tunnel Option	
Item description	Estimate	Totals	Notes
<i>Figures all at Q4 2008</i>			
Preparation:		£ 694,620.00	9% of Construction & Land
Supervision:		£ 386,000	5% of Construction & Land
Construction Cost:			
Preliminaries (incl. Traffic Management)	£ 1,543,000		25% of Construction
100 Prelims	£ 1,543,000		
Roadworks General	£ 172,000		Includes 20% for Contingencies
200 Site Clearance	£ 3,000		
300 Fencing	£ 3,000		
400 Road Restraint Systems	£ 17,000		
600 Earthworks	£ 120,000		
Main Carriageway/Side Roads	£ 162,000		Includes 20% for Contingencies
500 Drainage	£ 35,000		
700 Pavement	£ 100,000		
1100 Kerbs and Footways	£ -		
Signs, lighting etc	£ 2,000		Includes 20% for Contingencies
1200 Traffic Signs and Road Markings	£ 2,000		
Structures	£ 5,495,000		Includes 20% for Contingencies
1600 Piling & Embedded Retaining Walls	£ -		
1700 Structural Concrete	£ -		
2000 Waterproofing for Structures	£ -		
2500 Special Structures (Tunnel)	£ 4,579,000		
Landscape and Ecology	£ 59,000		1% of Construction
3000 Landscape and Ecology	£ 59,000		
Accommodation Works	£ 180,000		3% of Construction
Works for SUs	£ 100,000		£100K assumed to be adequate
Construction Cost total (ex VAT)		£ 7,713,000.00	
Land		£ 5,000.00	No VAT on Land
Optimism Bias		£ 2,199,655.00	25% of Total Cost
Other costs (if applicable)		£ -	
Total VAT (if applicable)		£ 1,487,000.00	15% VAT on Works
Total scheme cost (inc VAT)		£ 12,485,000.00	

Table 3.2 Cost Estimate – Tunnel Option

Scheme Cost Estimate			
A82 Pulpit Rock		Shortened Option (Viaduct)	
Item description	Estimate	Totals	Notes
<i>Figures all at Q4 2008</i>			
Preparation:		£ 520,000.00	9% of Construction & Land
Supervision:		£ 289,000	5% of Construction & Land
Construction Cost:			
Preliminaries (incl. Traffic Management)	£ 1,495,000		35% of Construction
100 Prelims	£ 1,495,000		
Roadworks General	£ 126,000		Includes 20% for Contingencies
200 Site Clearance	£ 7,000		
300 Fencing	£ 5,000		
400 Road Restraint Systems	£ 25,000		
600 Earthworks	£ 68,000		
Main Carriageway/Side Roads	£ 145,000		Includes 20% for Contingencies
500 Drainage	£ 41,000		
700 Pavement	£ 80,000		
1100 Kerbs and Footways	£ -		
Signs, lighting etc	£ 4,000		Includes 20% for Contingencies
1200 Traffic Signs and Road Markings	£ 3,000		
Structures	£ 3,732,000		Includes 20% for Contingencies
1600 Piling & Embedded Retaining Walls	£ 360,000		rock cut and retaining works to allow c/way widening
1700 Structural Concrete	£ -		
2000 Waterproofing for Structures			including under 2500 as appropriate
2500 Structures	£ 2,750,000		Viaduct Structure(180m)
Landscape and Ecology	£ 41,000		1% of Construction
3000 Landscape and Ecology	£ 41,000		
Accommodation Works	£ 124,000		3% of Construction
Works for SUs	£ 100,000		£100K assumed to be adequate
Construction Cost total (ex VAT)		£ 5,767,000.00	
Land		£ 6,000.00	No VAT on Land
Optimism Bias		£ 1,645,500.00	25% of Total Cost
Other costs (if applicable)		£ -	
Total VAT (if applicable)		£1,112,000.00	15% VAT on Works
Total scheme cost (inc VAT)		£ 9,340,000.00	

Table 3.3 Cost Estimate – Shortened Option (Viaduct)

Scheme Cost Estimate			
A82 Pulpit Rock		Shortened Option (Retaining Structure)	
Item description	Estimate	Totals	Notes
Preparation:			
		£ 498,000	Figures all at Q4 2008 9% of Construction & Land
Supervision:			
		£ 277,000	5% of Construction & Land
Construction Cost:			
Preliminaries (incl. Traffic Management)		£ 1,432,000	35% of Construction
100 Prelims	£ 1,432,000		
Roadworks General		£ 574,000	Includes 20% for Contingencies
200 Site Clearance	£ 10,000		
300 Fencing	£ 5,000		
400 Road Restraint Systems	£ 68,000		
600 Earthworks	£ 95,000		
600 Earthworks (open joint treatment)	£ 300,000		
Main Carriageway/Side Roads		£ 280,000	Includes 20% for Contingencies
500 Drainage	£ 72,000		
700 Pavement	£ 152,000		
1100 Kerbs and Footways	£ 9,000		
Signs, lighting etc		£ 4,000	Includes 20% for Contingencies
1200 Traffic Signs and Road Markings	£ 3,000		
Structures		£ 2,976,000	Includes 20% for Contingencies rock cut and retaining works to allow c/way widening
1600 Piling & Embedded Retaining Walls	£ 360,000		
1700 Structural Concrete	£ -		
2000 Waterproofing for Structures	£ -		Included in 2500 as appropriate
2500 Structures (ret wall)	£ 2,120,000		Embedded Retaining Structure At Loch Side
Landscape and Ecology		£ 39,000	
3000 Landscape and Ecology	£ 39,000		1% of Construction
Accommodation Works		£ 119,000	3% of Construction
Works for SUs		£ 100,000	£100K assumed to be adequate
Construction Cost total (ex VAT)		£ 5,524,000	
Land		£ 6,000	No VAT on Land
Optimism Bias		£ 1,576,000	25% of Total Cost
Other costs (if applicable)		£ -	
Total VAT (if applicable)		£ 1,065,000	15% VAT on Works
Total scheme cost (inc VAT)		£ 8,946,000	

Table 3.4 Cost Estimate – Shortened Option (Retaining Structure)

3.6.2 Assumptions in Cost Estimates

In producing the Cost Estimates, a number of assumptions have been made where quantities were not possible to be calculated. Many of those assumptions are of a general nature and as such, apply to all options. Others are specific to a particular option and in such case, further details are given. The accuracy reflects the amount of detail available at this stage.

Preliminaries

Preliminaries were taken to be 25% of the Works Total for the Viaduct Option and the Tunnel Option, 35% has been assumed for both the Shortened Options. This reflects the difficult nature of the site and the works involved.

Site Clearance

A general rate was applied in relation to the size of the site.

Fencing

Provision of new fencing has been accounted for on the west side of the road, over the length of the road.

Safety Fencing

For the Tunnel Option appropriate connections of the restraint system to the tunnel portal were accounted for. Parapet costs for the Viaduct option and Shortened options have been covered under 'special structures'.

Earthworks

Earthworks quantities were calculated using 3-Dimensional models produced for each option with the exception of the Tunnel Option where it is included in the Structures cost.

As the outcome of the Ground Investigation work has not been fully assessed, several assumptions had to be made. These assumptions were:

- 80% of acceptable fill material from rock excavation;
- 20% of unacceptable material from rock excavation;
- 5% of topsoil material from general excavation;
- 50% of acceptable fill material from general excavation;
- 45% of unacceptable material from general excavation;
- 100% of unacceptable material to be disposed; and
- Thickness of existing pavement: 0.45m;
- Treatment of the open rock joint included in the Shortened Option (Retaining Structure).

Drainage

A filter drain along the west side of the A82 was assumed. For the Tunnel Option carrier drains and gullies were accounted for.

Pavement

The following pavement make-up was assumed for all options:

- 200mm sub-base
- 200mm roadbase
- 100mm basecourse
- 50mm wearing course

Traffic Signs and Road Markings

A general allowance has been made for traffic signs and road markings to suit the road layout and the transitions between the improved carriageway and existing A82.

Piling and Embedded Retaining Walls

The cost for Piling and Embedded Retaining Walls along the rock face (without the berm) is incorporated for the Shortened Option (Viaduct) and the Shortened Option (Retaining Structure).

Structures

The following provisions were made with regards to the construction of the special structures:

Tunnel Option

- Excavation and disposal
- Construction of Portals
- Lining;
- Miscellaneous (formation of entry/exit portals);
- Treatment of open rock joint;
- Drainage;
- Lighting;
- Retaining structure in advance of the South portal.

Shortened Option (Retaining Structure)

- Embedded Retaining Structure constructed from barge;
- Clear loch bank;
- Installation of permanent anchors;
- Backfill.

Viaduct Option and Shortened Option (Viaduct)

The costs for the Viaduct Option and Shortened Option (Viaduct) include all aspects of construction for the viaduct structure.

Landscape and Ecology

An allowance of 1% of the Works Total was made.

Accommodation Works

Accommodation Works requirements are subject to consultation with affected land and property owners. At this stage, accommodation works were taken to be 3% of the Works Total.

Works for Statutory Undertakers

An allowance of £100,000 was made for the diversion or protection of all the apparatus of the Statutory Undertakers. Final details and costs are subject to discussion with the relevant Statutory Undertakers.

Optimism Bias

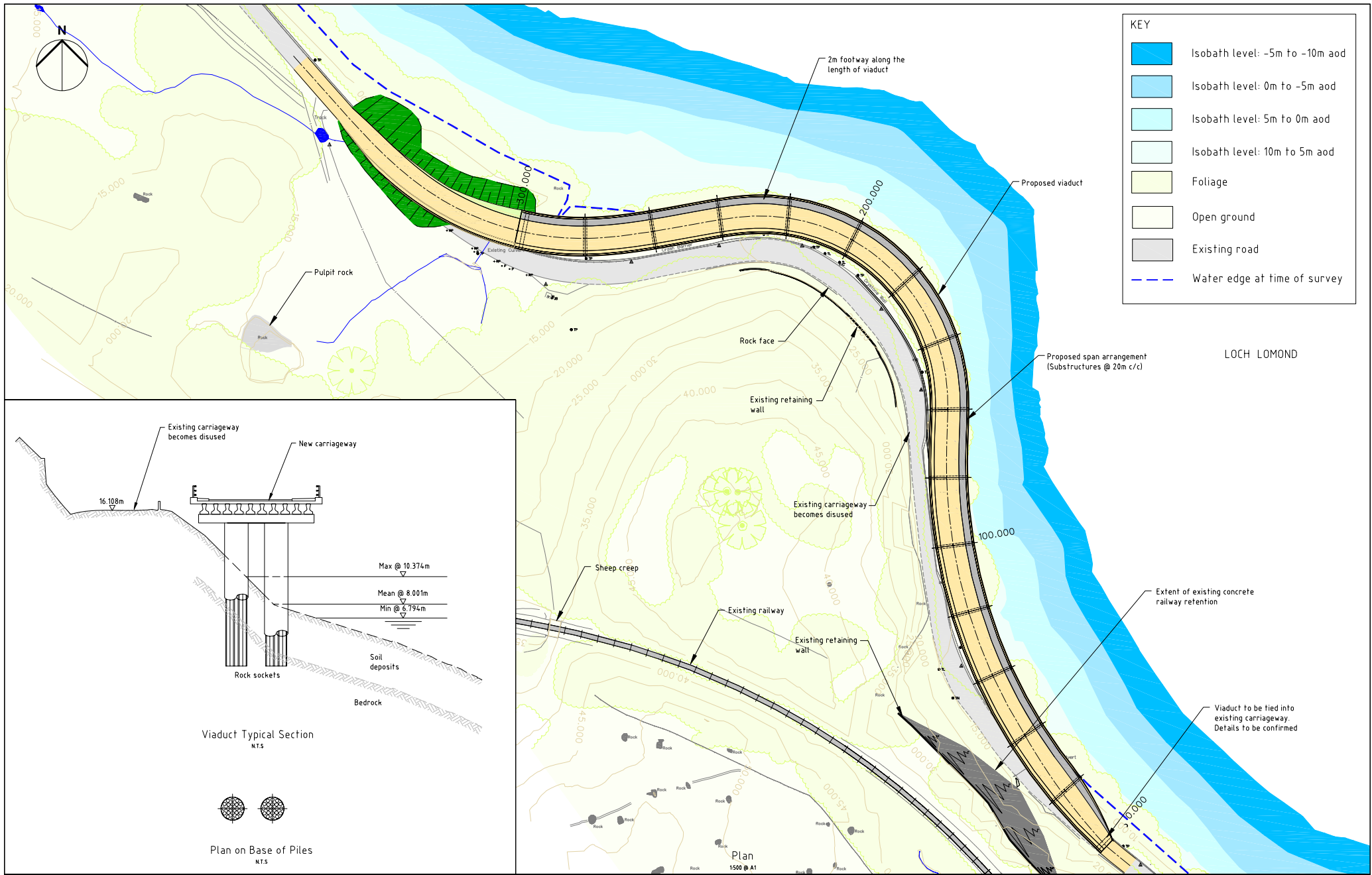
Optimism Bias is included in the cost estimates. According to the H.M. Treasury "Green Book" Appraisal and Evaluation in Central Government, Optimism Bias is the "demonstrated systematic tendency for appraisers to be over-optimistic about key project parameters, including capital costs, operating costs, works duration and benefits delivery". The NESAs manual (DMRB Vol.15) states that "the Scottish Executive advice, in relation to trunk road schemes with Total Scheme Costs (TSCs) of up to £50M, is to use an Optimism Bias of +25% TSCs at all stages of the assessment".

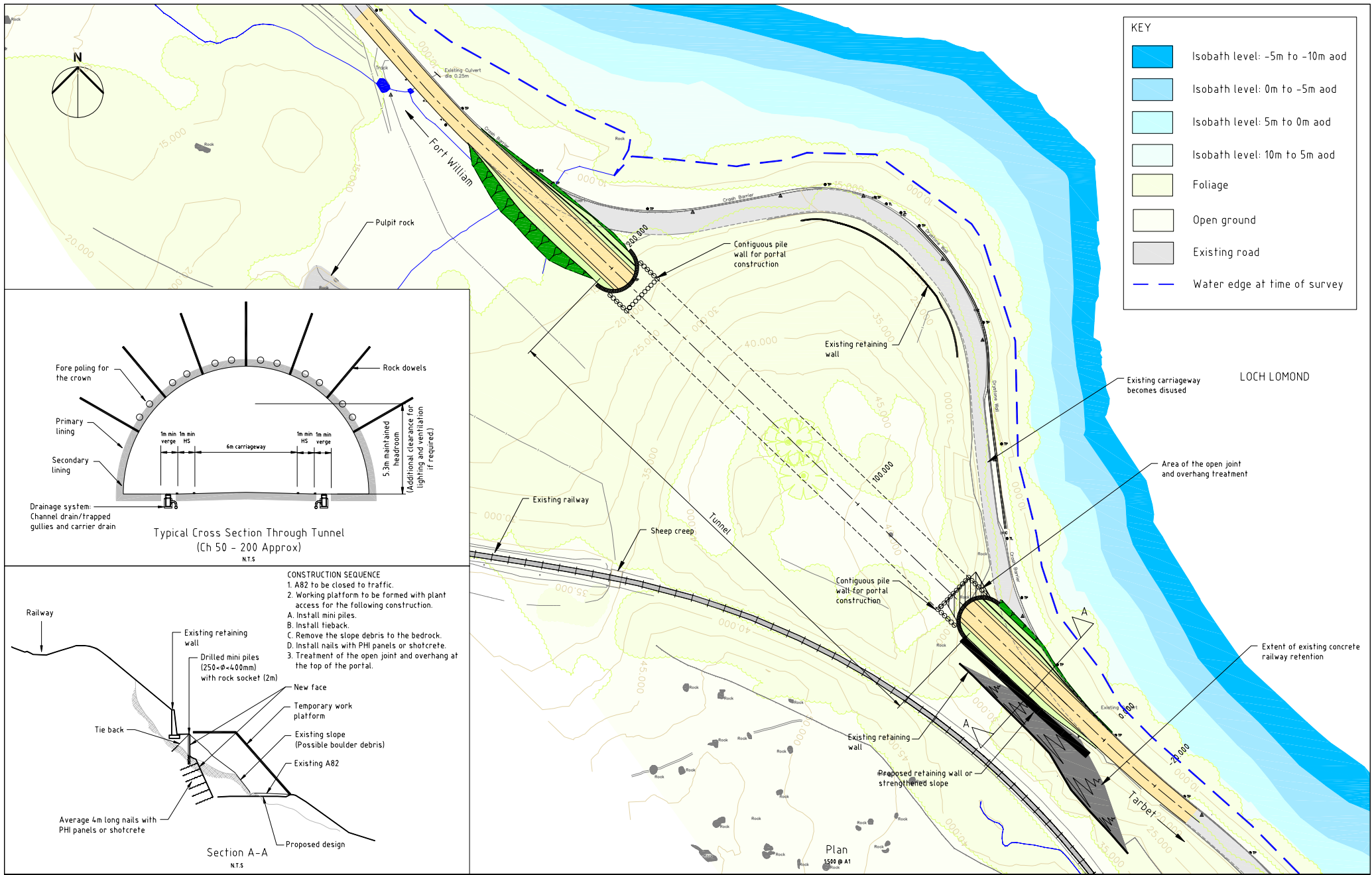
Land

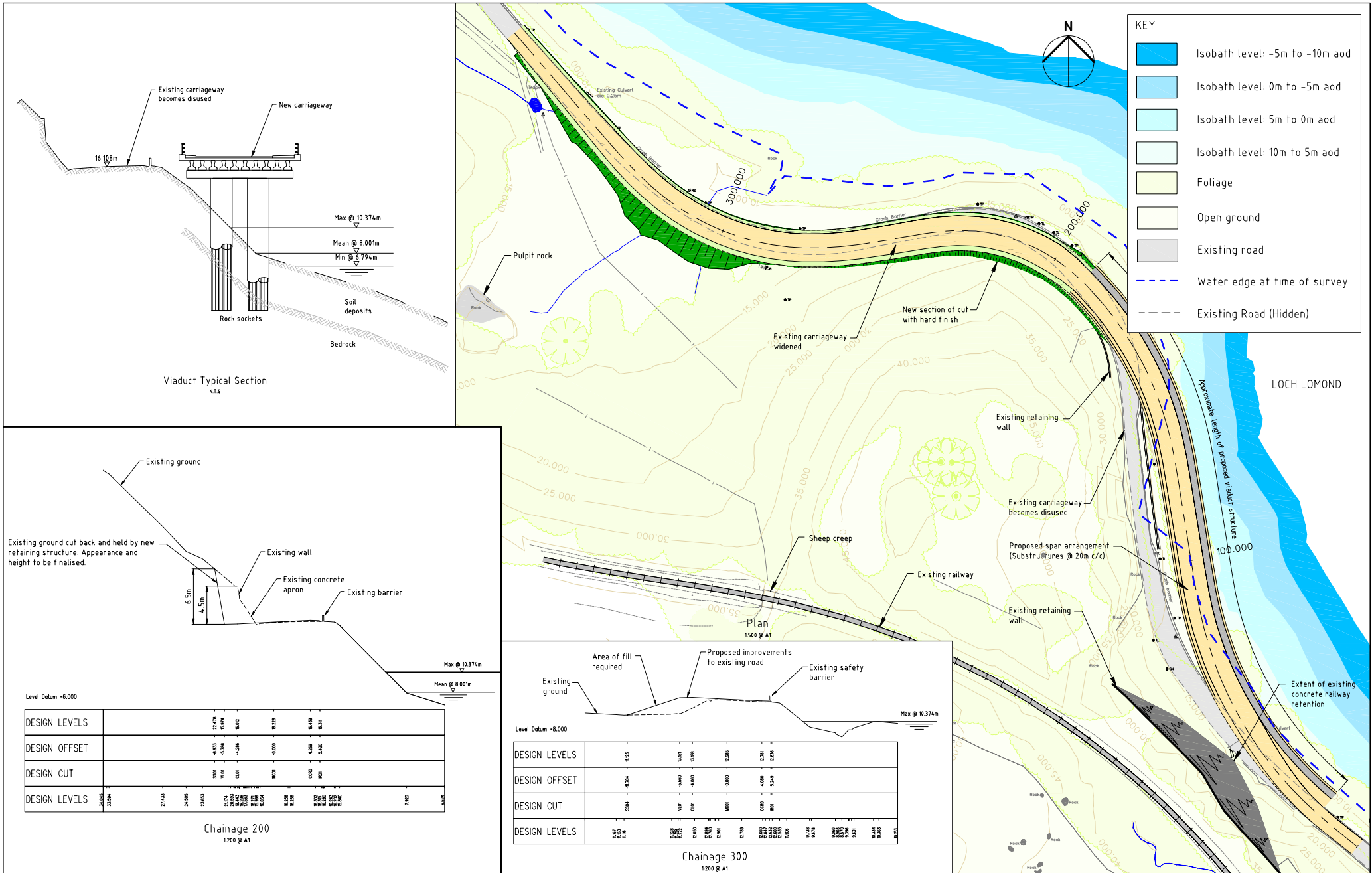
Land costs were calculated by applying a rate of £10,000 per hectare of required land.

Value Added Tax (VAT)

Finally, Value Added Tax was added to the Works Total. No VAT was applied to the land purchase costs.







4.0 Engineering Assessment

4.1 General

The speed limit on the A82 at Pulpit Rock is equal to the national speed limit of 60mph. All options considered in this report have been based upon a design speed of 70kph. All engineering standards in the scheme are based upon the Design Manual for Roads and Bridges (DMRB) and in particular TD 9/93 "Highway Link Design".

Significant issues arise in terms of highway geometry compliance with standards in 3 of the 4 options under consideration. The Tunnel option offers more straight forward geometry. Extensive discussions have taken place with Transport Scotland's Standards branch and after taking into account the characteristics of the A82 route their advice has been that proposed geometry replicating the existing situation would generally be acceptable. In fact, some concern was expressed regarding the potential introduction of substantially improved geometry because of the changes it may bring to driving behaviour.

There are several types of structures proposed under the 4 design options, including multi-span curved viaducts, a tunnel and embedded/piled retaining wall solutions. Whilst each of these structure types presents its own unique challenges and possibilities, the common threads that run through all of them are that they will be prominent, for both road users and visitors to the adjacent national park area, and complex, both in design and construction.

With the exception of the Tunnel option, all options have been developed on the basis that they will be constructed using floating working platforms or similar located in Loch Lomond adjacent to the site, to enable the works to be carried out whilst minimising impact on the local road traffic. These platforms would support piling equipment, construction equipment and form storage for materials. Modular systems are available which could be transferred to site and assembled to the required dimensions. Great care will be required during construction to ensure that the work is carried out safely.

A loading dock or similar will require to be provided at a suitable location (the location will be looked at in more detail as the Scheme is taken forward) on Loch Lomond to allow delivery of plant and materials to the locality. These can then be transferred to the site either by barge or by moving the floating work platforms in the case of large pieces of plant. For small quantities and volumes of material, local access points may be provided.

Unlike the other options, the Tunnel option will require stabilising and remedial works to an adjacent existing railway retaining wall. This will also require great care during construction to minimise any risk to the existing infrastructure.

4.2 Viaduct Option

The Viaduct Option provides a mainly offline structural solution with an overall length of approx 390m. This length is split between a viaduct type structure of approximately 300m and embankment of approximately 60m. An outline proposal has been developed and it is proposed to divide the structure into spans of approximately 20m as it winds round the Loch shoreline. The northern section of this option will be formed on a new embankment. Tie-ins and associated earthworks are to be provided at either end. Resurfacing works will be carried out at the start and end of the design covering 30m.

4.2.1 Layout Geometry

The Viaduct Option cross section consists of a 6m carriageway, curve widening with a setback of 1m on the west side and a 2m footway provision on the loch side. The cross section to the north of the viaduct will consist of a 6m carriageway, curve widening with a 1m verge on the west side and a 0.6m verge on the loch side..

The horizontal geometry for the option consists of 4 successive bends (right-left-right-right) of 150m, 55m, 80m and 1380m radii.

The vertical geometry consists of 3 successive curves, sag of $k=12$, crest of $k=15$ and a sag of $k=11$.

4.2.2 Departures from Standards / Relaxations

The horizontal geometry for the viaduct option consists of 3 substandard curves of 150m, 55m and 80m radii all falling well below the desirable minimum radius of 360m. Transition curves provided are also shortened below the desirable minimum standards. The vertical geometry consists of 2 sag curves, $k=12$ and $k=11$ and 1 crest curve, $k=15$. All k values fall 2 steps below the desirable minimum standard, sag $k=20$ and crest $k=30$. The stopping sight distances (SSD) achieved for this option fall below the desirable minimum of 120m, the worst case achieving a SSD of 36.4m through the 55m bend. The substandard vertical curves combined with substandard SSD's require a departure from standard. The required standard of superelevation for the horizontal radii provided is 7%. However, this is considered too severe for this location, therefore, the viaduct has incorporated a maximum superelevation of 5%. It is also anticipated that a relaxation regarding the width of setbacks provided on the structure (in accordance with TD 27 clause 4.11.13) will be required.

Should this option be taken forward, formal departure from standards applications will require approval. In the interim the standards achieved have already been discussed with Transport Scotland's standards advisors and it has been confirmed that the geometry proposals are acceptable in principle.

4.2.3 Ground Conditions and Earthworks

Ground engineering related issues are:

- The pier foundations indicated in the outline design will be constructed over the submerged sloping ground (i.e. the loch side slopes).
- The foundations will have to be built through the superficial deposits (i.e. slope debris), which overlie the bedrock.
- Deep foundations embedded into bedrock will be required.
- Shaft foundations will be formed through the superficial deposits.
- The north abutment could be built with approach embankment fill over the flat slopes along the loch side. The embankment fill will include geotextile separator to minimise the effects of submerged conditions and to prevent migration of fine materials.

4.2.4 Land

Land to be acquired for the Viaduct Option is approximately 5351m² although this will be dependent on the footprint of the finalised road geometry and viaduct design.

4.2.5 Drainage

It is proposed that a linear kerb drain will be utilised to collect surface run-off and drain pavement layers for the length of the viaduct structure. It is envisaged that a filter drain system will be utilised along the embankment section. All drainage run-off from the works will be collected and, wherever possible, treated before discharging to the loch. This will either be by a direct discharge through new outfalls or indirectly through the existing watercourses which cross the works.. Scottish Water and SEPA will be consulted fully regarding any proposals.

4.2.6 Public Utilities

The construction of the Viaduct Option will affect BT and Scotland Transerv apparatus. Further consultation with BT will be required in order to divert the existing apparatus during construction and to establish how it should be accommodated in the final works.

Scotland Transerv apparatus will be removed from the area as the improvements will eliminate the need for the traffic lights at this section of the A82.

4.2.7 Buildability

The Viaduct Option provides a mainly offline structural solution. It is likely to be formed from a multi-span viaduct structure, with piled foundations and typical internal spans of around 20m, tying into the existing carriageway by means of an embankment section at the north end.

Composition of the structure is still to be finalised and will be partly dependent upon the construction material chosen for the superstructure. Whilst it is expected that a reinforced concrete substructure will be provided, the superstructure may be formed from a number of material options (reinforced concrete, prestressed concrete, structural steel or structural weathering steel). The type and appearance of material to be proposed in the outline design will be looked at in more detail if the Viaduct Option is taken forward.

The construction of the viaduct will consist of several stages which will be programmed to ensure disruption and road closures are kept to a minimum. The proposed stages are as follows:

Site setup

During this stage of the works the site compound will be located and setup, floating working platforms will be established and traffic management will be put in place. Site clearance will also be undertaken at this stage. It is envisaged that closures during the site setup will be short term and will be in place for less than 1 hour at any one time.

Construction of Offline Works

It is proposed to build the offline section first. To minimise delays and closures of the existing road it has been assumed that works will be undertaken from floating working platforms. The first stage of the offline works entails installing temporary works such as

cofferdams and access measures. Once the cofferdams have been put in place, excavation of the material within the cofferdam is required. Following excavation to the appropriate depth the piles will be installed and the pile caps constructed. The columns and crossheads can then be formed, deck beams placed and the decking constructed. Although these works will be undertaken from the working platforms in the Loch it is anticipated that there will still be times when short term road closures will be required particularly when plant or equipment is being repositioned in close proximity to the road.

Construction of Online Tie-in Works to the North and South

Construction of the online tie-in sections will require similar works to the offline section. There will be some differences, however, dependent upon the form of abutment chosen. The type and appearance of abutment to be proposed in the outline design will be looked at in more detail if the Viaduct Option is taken forward.

Additionally, earthworks will be required along with the construction of the new barrier supports. The type and appearance of the embankment fill adjacent to the north abutment will be looked at in more detail if the Viaduct Option is taken forward, however it is likely that use of geotextile separators to minimise the effects of submerged conditions and to prevent migration of fine materials will be required.

It is envisaged that temporary works associated with these elements can be completed using short term closures.

Construction of the permanent works will require full closures.

Finishing Works

The finishing works will consist of fixing parapets, expansion joints, safety fencing and any other required fixings. Road surfacing and waterproofing will be carried out along with landscaping works. During this time traffic management will consist of one way traffic flow. Once the finishing works are completed, all traffic management will be removed.

4.3 Tunnel Option

The Tunnel Option provides a mainly offline structural solution with an overall length of approximately 340m incorporating a main tunnel length of approximately 150m. It is proposed to realign the existing road through a new tunnel structure, effectively straightening the road at this section of the network. Portals and associated earthworks are to be provided at either end interfacing with the existing road infrastructure. Extensive enabling and temporary works will be required for this option. Resurfacing works will be carried out at the start and end of the design covering 85m.

4.3.1 Layout Geometry

The Tunnel option consists of a 6m carriageway with 1m hardstrips. 2.5m verges are provided outwith the tunnel and 1m minimum verges are provided within.

The horizontal geometry consists of one straight element of 255m.

The vertical geometry consists of a crest curve of $k=55$ which conforms to the desirable minimum standards.

4.3.2 Departures from Standards / Relaxations

It is anticipated that the Tunnel Option can be constructed without the requirement for any application for Departures from Standards. There may be some concern arising as a result of the tighter curvature of existing road geometry on the approaches to the tunnel and the straightening of the road in between.

4.3.3 Ground Conditions and Earthworks

Ground engineering related issues are:

South Tunnel Portal (STP):

- There is an existing wall (masonry gravity) retaining the railway embankment fill over the sloping ground above the existing road.
- The wall shows no evidence of instability but should be reinforced prior to construction of the STP. The reinforcing measures could be in the form of anchoring and sprayed concrete and mesh supports. The STP side cut immediately below the wall should be reinforced by rock bolts and sprayed concrete and mesh support.
- The construction of the STP will also include active retaining measures for the slope debris overlying the bedrock on the site slopes. These measures could include secant pile and anchored walls or dental works (i.e. removal or rock bolting of unstable boulder size materials).
- The STP itself will include the treatment of open rock joints. Mica Schist bedrock shows characteristic joint systems that are typical examples of the past tectonic activities in the region (i.e. faulting and folding).

Tunnel Drive (TD):

- The tunnel will be constructed through Mica Schist bedrock.
- The preliminary ground investigation findings (i.e. boreholes and geophysical surveys) suggest variation in rock mass properties.
- The zones of fair to good rock mass are expected to form over the 60% of the TD.
- The zones of very poor to poor rock mass are expected to form 15% of the TD.
- The remaining section of the TD is expected to be in the zone affected by faulting.
- The rock mass characteristics can facilitate the use of drill & blast and machine excavation (road header machine). However, the proximity to the existing railway would limit the use of drill & blast excavation techniques.
- The available borehole data suggest that drainage measures will be required and can be incorporated with the tunnel lining.

North Tunnel Portal (NTP):

- The NTP will be constructed through superficial deposits, which overlie the bedrock.
- Therefore, a contiguous pile wall will be constructed to hold back the superficial deposits in order to minimise the portal cut height.
- The side long cuttings in the superficial deposits will have to be formed at a stable slope with either hard or soft landscaping measures.

4.3.4 Land

Land to be acquired for the Tunnel Option is approximately 4781m² although this will be dependent on the footprint of the final tunnel design.

4.3.5 Drainage

Any drainage run-off from the approaches to the Tunnel or from water collected within the opening will outfall to the loch, either directly or indirectly via a local watercourse once collected and treated.

4.3.6 Public Utilities

For the Tunnel Option, the construction of the portals will affect BT and Scotland Transerv apparatus. Further consultation with BT will be required in order to divert the existing apparatus during construction and to establish how it should be accommodated in the final works.

Scotland Transerv apparatus will be removed from the area as the improvements will eliminate the need for the traffic lights at this section of the A82.

4.3.7 Buildability

The Tunnel option will require the approach roads from the north and south to incorporate strengthened rock/soil slopes and structural elements to form the tunnel portals.

The proposed road and approach to the south end of the tunnel cuts into the hillside and potentially undermines the existing retaining wall below the West Highland Rail Line. It is likely that substantial works will be required at the bottom area of the existing wall to ensure stability is retained. Further detailed investigation of the wall and surroundings is required but it is thought at this stage that the required works will involve a combination of soil nailing and mini piling.

The tunnel drive itself will form a semi-circular cross-section of approximately 15m diameter. Temporary stability of the rock excavation can be obtained by rock bolting and shotcreting. It is envisaged that in-situ concrete will be used to form the permanent tunnel lining.

At the northern end of the drive, the tunnel portal will pass through a thickness of glacial till overburden. This may be 6m thick or more and presents a construction issue. Further investigation will assist in the decision on which strengthening measures are necessary or, alternatively, if removal is a more cost effective solution, allowing the material to be used elsewhere. Soil nailing may be viable, but is likely to require a structural element directly above the portal requiring significant temporary works.



None of the above issues present major technical difficulties but the cost implications will require further investigation to allow a complete assessment.

The construction of the Tunnel will consist of several stages which will be programmed to ensure disruption and road closures are kept to a minimum. The proposed stages are as follows:

Site Setup

During this stage of the works the site compound will be located and set up, traffic management will be put in place and site clearance will also be undertaken. Closures during the site setup will be short term and will be in place for less than 1 hour at any one time.

Existing Railway Line Retaining Wall

In order for the south portal to be constructed, a working platform must be built to enable access and allow the stabilisation works to the existing railway retaining wall to be carried out.

Construction of the South Portal and Approach Works

Following this, any ground treatment works required will be carried out to enable the construction of the portal. As the portal construction proceeds, the working platform can be brought down in level, until finally removed. Construction of the south portal will require full road closures.

Construction of the North Portal and Approach Works

The approach embankment to the north portal can be constructed in parallel with the construction of the working platforms. Ground treatment works will follow and then construction of the portal itself. As the portal construction proceeds, the working platform can be brought down in level, until finally removed. Construction of the north portal will require full road closures.

Construction of the Tunnel

Pre-tunnelling works such as ground treatment will be carried out first. The tunnel will then be constructed. In order for these works to be carried out it is anticipated that short term closures of less than 1 hour duration will be required. On finishing the tunnel construction, services such as drainage etc will need to be installed. During the installation of services, traffic management will consist of one way traffic flow.

Most of the material generated from the tunnel excavation will require to be removed from the site. It is unknown at this stage where it will be taken however it is assumed that vehicle movement will be merged in with the traffic management arrangement with minimal disruption to road users. Occasionally short term road closure of up to one hour will be required to accommodate the movement of equipment.

Finishing Works

The finishing works will consist of fixing safety fencing and any other required fixings. Road surfacing will be carried out along with landscaping works requiring short term road closures of less than 1 hour. At this time any remedial works required for the existing road will be completed, during this time traffic management will consist of one way traffic flow. Once the finishing works are completed, all traffic management will be removed.

4.4 Shortened Option (Viaduct)

This option provides improvements over a length of approximately 385m. The Shortened Option (Viaduct) is a partly offline structural solution which runs parallel to the loch shoreline for approximately 180m. It is proposed to split the structure into spans of approximately 20m as it hugs the loch shoreline. Tie-ins and associated earthworks are to be provided at either end interfacing with the existing road. From the northern end of the viaduct northwards, improvements to the existing road will extend for approximately 180m. A new rock cut requires to be excavated at the apex of the main bend to permit widening of the road. An existing retaining wall will be removed as a result of these works. Resurfacing works will be carried out at the start and end of the design covering 25m.

4.4.1 Layout Geometry

The Shortened Option (Viaduct) consists of a 6m carriageway, curve widening with a setback of 1m on the west side and a 2m footway provision on the loch side. Improvements to the existing carriageway will consist of a 6m carriageway with curve widening and a 1.5m verge on the west side.

The horizontal geometry for this option consists of 4 successive bends (right-left-left-right) of 107m, 95m, 50m and 70m radii

The vertical geometry consists of 3 successive curves, sag of $k=20$, crest of $k=10$ and a sag of $k=25$.

4.4.2 Departures from Standards / Relaxations

The horizontal geometry consists of 5 substandard curves of 108m, 95m, 50m, 70m and 165m radii. The desirable minimum radius for the Shortened Option (Viaduct) is 360m. The 108m and 95m radii curves fall 4 steps below the desirable minimum whereas the 165m radius falls 3 steps below. With regard to the 50m and 70m radii, and in accordance with section 3.12 of DMRB – TD 9/93, all radii below 90m on the mainline require a departure from standard. Transition curves provided are also shortened below the desirable minimum. The vertical geometry consists of 2 sag curves, $k=10$ and $k=21$ and 1 crest curve, $k=14$. The vertical sag curve of $k=10$ and the crest curve of $k=14$ both fall 2 steps below the desirable minimum standard, with the sag curve of $k=21$ conforming to standard. The stopping sight distances (SSD) achieved for this option fall below the desirable minimum of 120m. The worst case achieving a SSD of 40.4m through the 95m bend. The substandard vertical curves combined with substandard SSDs requires a departure from standard. The required standard of superelevation for the horizontal radii provided is 7%. However, this is considered too severe for this location, therefore, the viaduct has incorporated a maximum superelevation of 5%. It is anticipated that a relaxation along the viaduct structure may be required regarding the width of setbacks provided (in accordance with TD 27 cl 4.11.13).

Should this option be taken forward formal departure from standards applications will require approval. In the interim the standards achieved have already been discussed with Transport Scotland's standards advisors and it has been confirmed that the geometry proposals are acceptable in principle.

4.4.3 Ground Conditions and Earthworks

Ground engineering related issues for the viaduct are:

- The pier foundations indicated in the outline design will be constructed over the submerged sloping ground (i.e. the banks of the loch along the existing road).
- The foundations will have to be built through the superficial deposits (i.e. slope debris), which overlie the bedrock.
- Deep foundations embedded into bedrock will be required.
- Shaft foundations will be formed through the superficial deposits

Ground engineering related issues for the reinforced rock cutting are:

- The reinforced rock cut can be formed along the hill side of the road.
- The rock outcrop suggests that the cutting should be fully reinforced in order to minimise long term maintenance needs and avoid serviceability issues.
- The rock mass (Mica Schist) could be excavated by pre-splitting and reinforcement of the cutting could facilitate a steeper cut face and minimise the height.
- A combination of rock bolts, sprayed concrete and wire mesh placement could provide finished hard faced earthworks with minimal maintenance requirements.

4.4.4 Land

Land to be acquired for the Shortened Option (Viaduct) is approximately 5038m² although this will be dependent on the footprint of the finalised road geometry and viaduct design.

4.4.5 Drainage

It is proposed that a linear kerb drain will be utilised to collect surface run-off, along the viaduct section, and drain pavement layers. For the improvements beyond the viaduct's northern tie-in, it is proposed that a filter drain will be provided. Where practical, drainage will be collected and treated before outfalling to the loch, either directly or indirectly via one of the local watercourses crossing the works. Scottish Water and SEPA will be consulted fully regarding any proposals.

4.4.6 Public Utilities

The construction of the Shortened Option (Viaduct), will affect BT and Scotland Transerv apparatus. Further consultation with BT will be required in order to divert the existing apparatus during construction and to establish how it should be accommodated in the final works.

Scotland Transerv apparatus will be removed from the area as the improvements will eliminate the need for the traffic lights at this section of the A82.

4.4.7 Buildability

The Shortened Option (Viaduct) provides a partly offline structural solution. It will be a multi-span viaduct structure, with piled foundations and typical internal spans of around 20m. It is proposed to build the offline section first, to minimise delays and closures of the existing road. Once the offline section has been completed, the new rock cut at the north end of the scheme requires to be constructed. Once this has been built, work can commence on construction of the tie-ins to the north and south of the new viaduct structure. Earthworks associated with widening of the existing geometry to the north of the scheme will also be carried out at this stage.

Composition of the structure is still to be finalised and will be partly dependent upon the construction material chosen for the superstructure. Whilst it is expected that a reinforced concrete substructure will be provided, the superstructure may be formed from a number of material options (reinforced concrete, prestressed concrete, structural steel or structural weathering steel). The type and appearance of material to be proposed in the outline design will be looked at in more detail if this option is taken forward.

The construction techniques to be utilised for the new rock cut will depend upon the type of finish to be achieved. Fig 3.3 shows the works adopting a steeper slope. Options exist for adopting a shallower slope which would allow opportunities for a more natural finish. Such a slope would extend significantly higher and further back. Regardless of the final construction techniques chosen, it is likely that construction of the new rock cut will be carried out from the existing carriageway and require full road closures.

The construction of the Shortened Option (Viaduct) will consist of several stages which will be programmed to ensure disruption and road closures are kept to a minimum. The proposed stages are as follows:

Site Setup

During this stage of the works the site compound will be located and setup, floating working platforms will be established and traffic management will be put in place. Site clearance will also be undertaken at this stage. It is envisaged that closures during the site setup will be short term and will be in place for less than 1 hour at any one time.

Construction of Offline Works

It is proposed to build the offline section first. To minimise delays and closures of the existing road it has been assumed that works will be undertaken from floating working platforms. The first stage of the offline works entails installing temporary works such as cofferdams and access measures. Once the cofferdams have been put in place, excavation of the material within the cofferdam is required. Following excavation to the appropriate depth the piles will be installed and the pile caps constructed. The columns and crossheads can then be formed, deck beams placed and the decking constructed. Although these works will be undertaken from the working platforms in the Loch it is anticipated that there will still be times when short term road closures will be required particularly when plant or equipment is being repositioned in close proximity to the road.

Construct New Rock Cut

At this point construction of the new rock cut will commence. The type and appearance of the rock cut will be examined in more detail if the Shortened Option (Viaduct) is taken forward. It is likely that the rock cut will be fully reinforced, utilising a combination of rock bolts, sprayed concrete and wire mesh placement to provide a hard faced finish with

minimal maintenance requirements. Constructing the new rock cut will require full road closures.

Construction of Online Tie-in Works to the North and South

Construction of the online tie-in sections will require similar works to the offline section. There will be some differences, however, dependent upon the form of abutment chosen. The type and appearance of abutment to be proposed in the outline design will be looked at in more detail if the Shortened Option (Viaduct) is taken forward.

Additionally, earthworks will be required along with the construction of the new barrier supports. It is envisaged that temporary works associated with these elements can be completed using short term closures.

Construction of the permanent works will require full closures.

Finishing Works

The finishing works will consist of fixing parapets, expansion joints, safety fencing and any other required fixings. Road surfacing and waterproofing will be carried out along with landscaping works. During this time traffic management will consist of one way traffic flow. Once the finishing works are completed, all traffic management will be removed.

4.5 Shortened Option (Retaining Structure)

This option implements improvements along the A82 for approximately 380m. The Shortened Option (Retaining Structure) provides an online structural solution over a length of approximately 170m. It is proposed to reinforce the existing shore profile by installing a new backfilled retaining structure along the current narrowed section of road, thus reinstating two way traffic. Tie-ins and associated earthworks are to be provided at either end at the interface with the existing road. From the northern end of the wall northwards, improvements to the existing road will extend for approximately 190m. A new rock cut requires to be excavated at the apex of the main bend to permit widening of the road. An existing retaining wall will disappear as a result of these works. Resurfacing works will be carried out at the start and end of the design covering 20m.

4.5.1 Layout Geometry

The Shortened Option (Retaining Structure) will be of similar cross section to that of the Shortened Option (Viaduct). The main difference between the 2 cross sections is the need for a wider verge on the west side along the length of the proposed retaining structure. The cross section will therefore consist of a 6m carriageway with curve widening and incorporate a verge approximately 3m wide along the west side with a 2m footway provision along the loch side. The footway provision terminates at the same point as the Retaining Structure. The improvements to the existing carriageway northwards of this point will consist of a 6m carriageway, curve widening and a 1.5m verge on the west side.

The geometry for the Shortened Option (Retaining Structure) will be formed of similar elements to those listed for the Shortened Option (Viaduct). Refer to section 4.4.1

4.5.2 Departures from Standards / Relaxations

All departures for the Shortened Option (Retaining Structure) will be similar to the departures listed for the Shortened Option (Viaduct). Refer to section 4.4.2

4.5.3 Ground Conditions and Earthworks

Ground engineering related issues for the retaining structure along the shore are:

- The most important element of this option is the construction of the retaining structure through the superficial deposits overlying the bedrock.
- The geotechnical issues are similar to the ones listed for the viaduct pier foundations with added horizontal stresses due to the retained fill.
- The retaining structure could be partly driven partly bored pile walls through the superficial deposits with rock socketting.
- The facing of the wall could have precast panel facings.
- The formation of the rock socket into the bedrock is essential for providing toe fixity.
- The remaining height of the wall could be anchored back into the loch side slopes. Permanent anchors (i.e. having double corrosion protection) will have to be drilled into the rock mass through the slope debris.
- The earthworks involving the placement of the materials will have to be conducted from land with appropriate compaction plant.

Ground engineering related issues for the reinforced rock cutting are:

- The reinforced rock cut can be formed along the hill side of the road.
- The rock outcrop suggests that the cutting should be fully reinforced in order to minimise long term maintenance needs and avoid serviceability issues.
- The rock mass (Mica Schist) could be excavated by pre-splitting and reinforcement of the cutting could facilitate steeper cut face and minimise the height.
- The combination of rock bolts, sprayed concrete and wire mesh placement could provide the finished hard faced earthworks with minimal maintenance requirements.

4.5.4 Land

Land to be acquired for the Shortened Option (Retaining Structure) is approximately 5290m² although this will be dependent on the footprint of the final Shortened Option (Retaining Structure) design.

4.5.5 Drainage

It is proposed that a filter drain will be provided at the verge running along the west side of the design option to collect surface run-off and drain pavement layers. Drainage for the full length of the design is proposed to outfall draining to the loch, either directly or indirectly via a local watercourse once collected and treated. Scottish Water and SEPA will be consulted fully regarding any proposals.

4.5.6 Public Utilities

For the Shortened Option (Retaining Structure), the carriageway is locally widened which will affect BT and Scotland Transerv apparatus. Further consultation with BT will be required in order to divert the existing apparatus during construction and to establish how it should be accommodated in the final works.

Scotland Transerv apparatus will be removed from the area as the improvements will eliminate the need for the traffic lights at this section of the A82.

4.5.7 Buildability

The Shortened Option (Retaining Structure) is effectively an on-line widening of the existing carriageway, created by extending the eastern verge towards the loch by means of a new supporting wall structure along the eastern shoulder of the alignment and a new rock cut to the western verge at the north end of the proposed scheme. The new retaining structure will be keyed into the loch bed and tied back into the adjacent loch shore using permanent anchors, in order to support the new carriageway above. It is currently proposed to use commonly used Larssen or Frodingham sheet piles to form the retaining element. Alternative structural forms may be possible. These will be investigated at Detailed Design stage. Further investigation will confirm the selection of the sheet piling required.

The construction techniques to be utilised for the new rock cut will depend upon the type of finish to be achieved. Regardless of the final construction techniques chosen, it is likely that construction of the new rock cut will be carried out from the existing carriageway, using a variety of machines and access measures as appropriate.

The construction of the Shortened Option (Retaining Structure) will consist of several stages which will be programmed to ensure disruption and road closures are kept to a minimum. The stages are as follows:

Site setup

During this stage of the works the site compound will be located and setup and traffic management will be put in place. Site clearance will also be undertaken at this stage. It is envisaged that closures during the site setup will be short term and will be in place for less than 1 hour at any one time.

Construction of Embedded Pile Works

To construct the embedded pile works, temporary works and edge preparation works would be necessary. This will include constructing sheet pile guide frames and the provision of access measures. In order to carry out these works short term closures will be in place for less than 1 hour at any one time.



Exact details of piling works are dependent upon the size and type of piles used. This will be investigated at Detailed Design stage. Likewise, exact details of backfilling works will depend upon the particular pile system used. Regardless of the solution chosen, great care will be required whilst placing and compacting the selected backfill material, to avoid damaging or overstressing the anchors. Use of protective sleeves will be required and hand placing of backfill materials local to the anchor positions may be necessary. The health and safety implications of this type of works will have to be carefully considered.

Construct New Rock Cut

At this point construction of the new rock cut will commence. The type and appearance of the rock cut will be investigated in more detail if the Shortened Option (Retaining Structure) is taken forward. It is likely that the rock cut will be fully reinforced, utilising a combination of rock bolts, sprayed concrete and wire mesh placement to provide a hard faced finish with minimal maintenance requirements. Constructing the new rock cut will require full road closures.

Construct Online Section Works

The online works will see the construction of the earthworks and the new barrier supports, requiring full road closures to complete.

Finishing Works

The finishing works will consist of fixing parapets, safety fencing and any other required fixings. Road surfacing will be carried out along with landscaping works. During this time traffic management will consist of one way traffic flow. Once the finishing works are completed, all traffic management will be removed.

5.0 Environmental Assessment

5.1 Background

A Stage 2 environmental assessment of the options has been carried out in accordance with Volume 11 of the Design Manual for Roads and Bridges (DMRB), and the procedures recommended in Volume 5.

In August 2008 the DMRB was revised and updated affecting the procedures for the assessment of road schemes. Volume 11 which deals with environmental assessment has been comprehensively revised including changing assessment and reporting procedures and introducing screening and scoping procedures, non-statutory environmental assessment, Strategic Environmental Assessment and Assessment of Implications on European Sites (Natura 2000 sites).

The Pulpit Rock scheme was conceived and assessed to Stage 1 before the DMRB was revised. This Stage 2 assessment of the four proposed Scheme Design options has been carried out under the previous DMRB guidelines.

In addition, it should be noted that, with the exception of Air Quality and Traffic Noise & Vibration, the procedures for assessing the individual environmental topics have not yet been changed to reflect the revised DMRB consequential approach – hence the continuation with the DMRB Stage 2 approach in this transition period.

This chapter describes the environmental features and constraints of the scheme options, as outlined in Chapter 2. The appraisal assesses, in broad terms, the likely environmental effects and provides an early indication of preferred options.

The environmental overview considers the following environmental topics:-

- Policy and Plans;
- Landscape and Visual Effects;
- Air Quality;
- Traffic Noise and Vibration;
- Land Use;
- Archaeology and Cultural Heritage;
- Ecology and Nature Conservation;
- Pedestrians, Cyclists, Equestrians and Community Effects;
- Road Drainage and the Water Environment; and
- Disruption during Construction.

The function of the environmental information in this Stage 2 report is to identify, describe and assess the environmental advantages, disadvantages and constraints associated with the options considered in this report. In support of this a number of Figures have been prepared and these can be found at the end of Chapter 5. These include:

- Figure 5.1 - Environmental Constraints
- Figure 5.2 – Air Quality
- Figure 5.3 – Traffic Noise and Vibration
- Figure 5.4 – Road Drainage and the Water Environment
- Figure 5.5 – Landscape Character Photos
- Figure 5.6 – Visual Analysis

The assessment process has included consultations and site visits in order to ensure the appropriate level of environmental information is identified for each of the defined options.

5.2 Policy and Plans

The purpose of this section is to determine whether or not the Scheme shows consistency with current policy and guidance. This section has been produced in line with the advice and guidance contained in Volume 11 (Section 3 Part 12) of DMRB. Sources of information used include National, Regional and Local policy documents as follows:-

- National Planning Framework (NPF) (2004)
- National Planning Framework for Scotland 2 (NPF2) (July 2009)
- Scottish Planning Policy (SPP) (Parts 1 and 2 October 2008, Part 3 Consultative Draft April 2009)
- Scottish Planning Policy documents (SPPs);
- National Planning Policy Guidance (NPPGs);
- Planning Advice Notes (PANs);
- Adopted Argyll and Bute Structure Plan: Developing Our Future (November 2002);
- Argyll and Bute's Local Transport Strategy 2007 – 2010: Moving Forward (Undated);
- Adopted Loch Lomond and the Trossachs National Park Plan 2007-2012 (March 2007);
- Loch Lomond and the Trossachs National Park Consultative Draft Local Plan (November 2008); and
- Adopted Dumbarton District Wide Local Plan (March 1999).

Consultation with the Loch Lomond and Trossachs National Park Authority has been undertaken. The Local Lomond and the Trossachs National Park Consultative Draft Local Plan (November 2008) which has completed its public consultation period is still not yet adopted whilst the Loch Lomond and the Trossachs National Park (LLTNP) Core Paths Plan Consultation Draft is still to be finalised and submitted to the Scottish Government following the conclusion of the formal public consultation period during the summer of 2008. Nevertheless, both documents have been referred to as a material consideration.

Some of the policies and their implications are referred to in other sections within this Report, such as Landscape and Visual (5.3) and Archaeology and Cultural Heritage (5.7) whilst

extracts from the Core Paths Plan Consultation Draft document – relevant to the proposed Pulpit Rock Scheme - are contained in the Pedestrians, Cyclists and Community section (5.9).

5.2.1 National Policy

The National Planning Framework (NPF) supports *the promotion of economic growth, promoting social inclusion and accessibility, ensuring that the development of transport is sustainable and minimising the environmental impact of travel. This has been accompanied by a major shift in the balance of public sector investment towards more sustainable transport options while maintaining and enhancing the trunk road network and supporting maintenance of the local road network* (Paragraph 42).

Paragraph 72 states *In some rural areas, improvements in transport infrastructure are needed to support economic activity and improve access to social facilities.*

National Planning Framework for Scotland 2 (July 2009) paragraph 132 states *For trunk roads, the Government is focusing on tackling congestion where it affects journey time reliability, targeted enhancement of capacity, managing demand on the network and addressing the accessibility needs of rural areas...The A82 and A83 trunk roads are key strategic routes for the Highlands and Islands. Targeted improvements between Glasgow and Fort William have been identified as a priority by the STPR.... ...Many roads in the Highlands and Islands and the South of Scotland are lifeline routes for rural communities and of critical importance to the local economy. Their continued maintenance and improvement is essential to ensure the safety of the network and to support long term development.*

As well as the NPF, guidance and advice is also available in the form of Scottish Planning Policies (SPPs) and National Planning Policy Guidelines (NPPGs) which set out the detail on a comprehensive range of land-use planning issues and is designed to supplement the implementation of the NPF. The Scottish Planning Policy (SPP) and National Planning Policy Guidance (NPPG) series' are being consolidated into one document. Parts One and Two were published as Scottish Planning Policy (SPP) on 28 October 2008, superseding SPP1 The Planning System (2002). The remaining sections of the consolidated SPP was published on 1 April 2009. The consultation closed on 24 June 2009. The subject policies, currently set out in SPPs and NPPGs, will remain in force until replaced by the consolidated SPP. There are a number of relevant SPPs and NPPGs, which are set out in Table 5.2.1 below.

The Scottish Government also produce Planning Advice Notes (PANs) that complement the Scottish Planning Policies. PANs that are relevant to the Scheme include – PAN 42 Archaeology, PAN 60 Planning for Natural Heritage, PAN 61 Planning and Sustainable Urban Drainage Systems, PAN 75 Planning for Transport and PAN 79 Water and Drainage. Relevant guidance from these documents is not reproduced here, but has been considered in assessing the scheme.

SPP/SPPs/ NPPGs	Relevant Issue
Scottish Planning Policy (Parts 1, 2 and 3)	Parts 1 and 2 provide a brief overview of the current land use planning system in Scotland.
	Part 3 (currently in consultative draft form) consolidates and condenses the various subject policies from NPPG and SPP planning policy series.
SPP 15: Planning and Rural Development	Provides guidance on development issues affecting Rural areas.
SPP 17: Planning for Transport	Details how land use planning should be integrated with transport policy.
SPP23: Planning and the Historic Environment	Sets out the national planning policy for the historic environment and indicates how the planning system will contribute towards the delivery of Scottish Ministers' policies as set out in the current Scottish Historic Environment Policy (SHEP) 2 produced by Historic Scotland
NPPG 14: Natural Heritage	Details the level of protection to be given to designated areas.

Table 5.2.1: Relevant Planning Policy Statements

5.2.2 Adopted Loch Lomond and the Trossachs National Park Plan 2007-2012

The proposed Scheme will be assessed against the aims of the National Park Plan which are as follows:-

- To conserve and enhance the natural and cultural heritage of the area;
- To promote sustainable use of the natural resources of the area;
- To promote understanding and enjoyment (including enjoyment in the form of recreation) of the special qualities of the area by the public; and
- To promote sustainable economic and social development of the area's communities.

All the above four aims have equal status but conservation interests are given increased priority if there appears to be an unavoidable conflict with any of the other three aims.

The relevant Loch Lomond and the Trossachs National Park Plan (March 2007) policies that are relevant to the A82 Pulpit Rock proposal are as follows (other general policies within the Park Plan will be adhered to throughout scheme progression):

- **Policy INF1 'Addressing Infrastructure Constraints and Improvements'** - Public investment is required in the Park's infrastructure at key locations to meet the social and economic needs of the Park's communities and specifically to support their sustainable development. Priorities for investment include:-
 - Improvements to the A82 trunk road corridor north of Tarbet and around Crianlarich, which must be sympathetically designed to deliver the necessary road infrastructure standards in the context of the Park's special qualities and the scenic experience.

- Ensuring a high standard of road network that meets the needs of visitors, communities and businesses, and is sympathetic to the area's special qualities utilising sensitive road engineering principles. This will involve targeting and prioritisation of roads maintenance budgets.
- **Policy TR2 'Improving the Transport Network'** - The transport network for road, rail and water services in and around the Park will be sustained and improved to better meet the needs of the Park's communities, visitors and businesses, encourage greater use of public transport and reduce the environmental effects of travel.
- **Policy LS1 'Conserving and Enhancing the Diversity and Quality of the Park's Landscapes'** - The diversity and quality of the Park's landscapes, their distinctive patterns and features that contribute to the landscape character and support the quality of Landscape experience, will be conserved and enhanced. This will involve:
 - a) Nurturing the local distinctiveness of the Park's landscape areas.
 - b) Safeguarding, enhancing and, where appropriate, restoring the important historic dimension of the Park's landscapes.
 - c) Promoting high quality standards in landscape design.
 - d) Reviewing and rationalising the current system of landscape designation in the Park, while continuing to regard National Scenic Areas as being of exceptional landscape quality.
 - e) Producing a more detailed Landscape Strategy to define the scope for, and guide, landscape change in different parks of the Park.
 - f) Encouraging and supporting initiatives, projects and actions to conserve, enhance and, where appropriate, restore landscapes.
 - g) Working partnership with landowners, land managers and local communities to *access resources for landscape management and enhancement*.
- **Policy LS2 'Landscape Character'** – The character of the Park's landscapes, particularly in relation to uplands, open landscapes, forests, woodlands and trees, lochs, sea lochs and rivers, farmed and historic landscapes, will be conserved and enhanced in accordance with the objectives and guidelines set out in Schedule 1, and alongside other relevant Park Plan policies relating to biodiversity, land and water management and built heritage.
- **Policy LS3 'Landscape Experience'** - The landscape experiences of the Park will be conserved and enhanced through:-
 - Safeguarding the visual and scenic qualities of the landscape from inappropriate or insensitive development or land use change.
 - Safeguarding important views, viewpoints and landmarks from development or land use change that would detract from their visual integrity, contribution to the identity of the place and scenic quality and, where appropriate, encouraging access to and opening up of new views.
 - Enhancing the experience of travelling the Park's routes, particularly the views from road, rail and long distance routes.

- Safeguarding the unspoilt, wild and tranquil qualities of the Park's landscapes by resisting development or land use activities that have adverse effects on these qualities.
- Conserving the experience of the night sky in less developed areas of the Park through design solutions with low light impact.
- **Policy LM3 - Woodlands and Forests Providing Multiple Benefits** - In addition to the provisions of Policies LM1 (Integrated and Sustainable Land Management) and LM2 (Best practice in Land Management), the management, restructuring and new establishment of forests and woodlands in the Park will deliver a range of benefits as promoted by the Local Woodland and Forestry Framework and set out in other policies of the Plan.
- **Policy WM1 'Safeguarding and Enhancing the Water Environment'** - A strategic approach to safeguarding and enhancing the Park's water environment will be delivered through a coordinated catchment-based approach to management, led by SEPA and delivered by a range of partners.
- **Policy REC2 'Outdoor Recreation and Access Opportunities'** - Each area's capacity to accommodate recreational activity and associated visitor numbers without detriment to its special qualities and quality of the recreation experience will guide the strategic management of outdoor leisure and recreation activities throughout the Park

5.2.3 Loch Lomond and the Trossachs National Park Consultative Draft Local Plan (2008)

The Loch Lomond and Trossachs National Park Authority is currently preparing a new Local Plan for the whole of the National Park that will set out detailed policies and site-specific proposals for development. It will be used to guide day-to-day planning decisions and will have a life span of five years. A consultative draft version of the Local Plan (November 2008) has been produced for consultation purposes as part of the preparation of the National Park Local Plan, indicating the likely future direction and content of the finalised Local Plan. Although not an adopted document, this has been reviewed as a material consideration.

In terms of Transport, the Consultative Draft Local Plan (Section 3.2, p14) states that:

"The A82 Trunk Road between Tarbet and Crianlarich is in an extremely poor state of repair and is the source of continuous comment and complaint from road users, communities and businesses served by the road corridor. We will work closely with Transport Scotland to ensure that the route can be upgraded sensitively and appropriately and in a manner befitting the special qualities of this most sensitive part of the National Park. Specific projects at Pulpit Rock and Crianlarich Bypass will require careful design considerations. Similarly, road realignments will require non-standard design approaches responding to local character and sensitivities."

- **Policy TRAN1 'Safeguarding Sites to Improve the Transport Network'** – Land will be safeguarded for, and support will be given to, the transport infrastructure proposals identified in Schedule 7.

Location	Transport Infrastructure Proposals	Development Constraints/Requirements
A82, north of Tarbet	Improvements to trunk road corridor	Landscape and visual impact assessment

Schedule 7 Transport Infrastructure Proposals

- **Policy TRAN4 ‘Provision of New Roads and Road Improvements’** - New road proposals, including road accesses and road upgrading, will be required to apply road engineering principles that are sensitive to the Park’s special qualities.
- **Policy TRAN6 ‘Encouraging Outdoor Access’** - Policy TRAN6 protects the general right of responsible access to the outdoors, including core paths, rights of way and the wider access network of both formal and informal paths from inappropriate development. Development proposals will encourage outdoor access by:-
 - Safeguarding, enhancing or providing appropriate alternative provisions to existing access rights, core paths, rights of way and the wider access network of formal and informal paths; and
 - Enabling access opportunities for the public including appropriate provision for users such as pedestrians, cyclists etc and encouraging local and longer distance journeys by providing on-site access and appropriate safe links to the wider area.
- **Policy L1 ‘Conserving and Enhancing the Diversity and Quality of the Park’s Landscapes’** - Development proposals will be required to conserve and enhance the special landscape qualities of the Park and demonstrate that:-
 - They do not erode local distinctiveness, diversity and quality of the Park’s landscape character areas, the historic dimension of the Park’s landscapes, visual and scenic qualities of the landscape, or the quality of landscape experience;
 - They safeguard views, viewpoints and landmarks from development that would detract from their visual integrity, identity or scenic quality;
 - They safeguard the tranquil qualities of the Park’s landscapes;
 - They provide high quality standards in landscape design, including landscape enhancement and mitigation schemes when there is an associated impact on landscape special qualities;
 - They incorporate measures for protecting and enhancing the ecological, geological or geomorphological, archaeological, historic and visual amenity elements of the landscape; and
 - They conserve the experience of the night sky in less developed areas of the Park through design solutions with low light impact.

Until it is possible to assess the acceptability of development proposals against a Parkwide landscape strategy, associated local landscape capacity studies and local objectives, there shall be an overriding priority given to the conservation and enhancement of National Scenic Areas as a landscape entity.

Other relevant policies of the local plan that will need to be adhered to through scheme progression include:

- **Policy D1 - Design Quality** (policy states that proposals must be of a high quality design respecting local context.)
- **Policy ENV4 'Legally Protected Species'** (Development will not be permitted where it would have an adverse impact on any European protected species or any species protected under national legislation.)
- **Policy ENV5 'Species and Habitats Identified in National Action Plans'** – (Development that would have an adverse impact (including cumulative impact) on habitats or species identified in the UK Biodiversity Action Plan or on the Scottish Biodiversity List will only be permitted in certain circumstances as defined within the policy.)
- **Policy ENV8 'Ancient, Long-established and Semi-natural Woodlands'** – (Planning permission will not be granted for any development that would result in the loss or deterioration of an ancient, long-established or semi-natural woodland unless there are social and economic benefits of national importance from the development that outweigh the loss of the woodland habitat.)
- **Policy ENV9 'Development Impacts on Trees and Woodlands'** – (The Park Authority will resist development likely to lead to the loss or damage to important individual trees or groups of trees, or woodlands that contribute to local amenity, the character of the area and/or are of nature conservation value or historic significance.)
- **Policy ENV10 'Protecting the Water Environment'** – (Where appropriate, new development will be required to protect and enhance the natural heritage and landscape values of water bodies, minimise any potential negative impacts that development may have on water quality; protect opportunities for recreation and enjoyment on and around lochs, rivers, burns, wetlands and the coastal marine area; and have regard to any international designated bathing waters in the Park.)
- **Policy ENV25 'Scheduled Monuments and Candidate Scheduled Monuments'** – (Scheduled Monuments will be preserved in situ within an appropriate setting and development will not be permitted which adversely affects scheduled monuments or their settings. The Park Authority, in consultation with its archaeological advisors and Historic Scotland, will deal with candidate sites for scheduling as if they were scheduled.)

5.2.4 Adopted Argyll and Bute Structure Plan: Developing out Future (2002)

The Argyll and Bute Structure Plan is still a material consideration for the study area. Relevant policies are listed below:

- **Strategic Issue 6** - The need to improve the A82 Trunk Road, taking into consideration the strategic importance of this road in terms of its trunk road function serving major events on Loch Lomond-side and giving access to Helensburgh, the west and the north; the road not being wholly fit for these purposes particularly the section northwards of Tarbet.



- **REC SI 2 – A82 Trunk Road Improvement** Argyll and Bute Council and the National Park interim committee or future National Park Authority, in liaison with the Scottish Executive, consider costs and benefits and programming opportunities for further road improvement to the A82 Trunk Road.

There are a number of other general policies within the structure plan that are relevant to the scheme development, for example with regards to historic environment and impacts on woodlands.

5.2.5 Argyll and Bute's Local Transport Strategy 2007-2010: Moving Forward

Chapter 3 of the transport strategy under section 3.1.1 **Strategic Road Networks Action I 01** indicates the implementation of a programmed approach to road improvements at the Western Bypass at Crainlarich and Pulpit Rock Tunnel, and Road Improvement between Tarbet and Inverarnan as priorities for the Strategic Road Network on the A82 Corridor.

5.2.6 Adopted Dumbarton District Wide Local Plan – March 1999

Policy TA1 – Transportation Policy - The Council supports the principle of an integrated transport system, including both public and private modes: - Proposals are listed in Schedule TA1 which identifies the A82 north of Tarbet for a comprehensive and phased programme of road improvements.

There are a variety of other policies within the Local Plan that are of relevance to the scheme development, these include:

- **Policy NHL6 – Trees, Woodlands and Forestry** (safeguarding of existing trees and woodland.)
- **Policy NHL10 – Nature Conservation** (protection of flora and fauna protected by law.)
- **Policy NHL11 – Foreshore Areas** (presumption against development unless considered essential in accordance with other local plan policies.)
- **Policy NHL18 – Landscape** (overriding priority to the conservation and enhancement of the intrinsic landscape character of the Loch Lomond National Scenic Area.)
- **Policy NHL20 – Landscape** (Council will undertake and/or support landscape improvement projects.)
- **Policy BE13 – Scheduled monuments, Industrial Archaeology and Sites of Archaeological Significance** (presumption against development which would destroy or adversely affect archaeological sites.)

5.2.7 Mitigation

Generally mitigation measures are outlined in the specific environmental topic sections within this report and which were listed in section 5.1. However, detrimental effects in terms of policy implementation will be reduced or avoided by implementing best practice standards during construction, so that the scheme can contribute more appropriately to policies.

5.2.8 Summary

There are no designated developments or land allocations contained in any of the development plans relevant to Pulpit Rock or the immediate surrounding environment. The Scheme is generally supported by the development plans. The compatibility and implications of the Scheme design options with the relevant identified policies are described in further detail in subsequent sections.

5.3 Landscape and Visual Effects

5.3.1 Introduction

This Stage 2 assessment examines the landscape and visual impacts that are likely to occur as a result of the options under consideration. The assessment describes and evaluates the physical landscape and visual amenity of the study area and makes informed predictions of the likely effects upon them. The location of Pulpit Rock is shown in Figure 1.1. The four options are shown in Figures 3.1 to 3.4. There were no technical difficulties with carrying out this assessment. It was carried out on the basis of indicative option designs, cross sections, an outline written description of each option and site visits including a visit to the site by boat to assess the landscape context and views from the loch.

The study area contains some cultural heritage sites, which are described in Section 5.7, Archaeology and Cultural Heritage. The study area also contains long-established woodland of plantation origin, which is described together with other habitats in Section 5.8, Ecology and Nature Conservation.

5.3.2 Assessment Methodology

This assessment has been carried out in accordance with the methodology recommended by the DMRB Volume 11, together with best practice guidance recommended in the 'Guidelines for Landscape and Visual Assessment' Second Edition, The Landscape Institute/Institute of Environmental Management and Assessment (Spon Press 2002) (GLVIA). Interim Supplementary Guidance to the DMRB Volume 11 on Landscape and Visual Assessment issued by The Scottish Executive (11/02/02) has been largely superseded by the GLVIA but its criteria on sensitivity and magnitude has been used because it provides useful general guidance on landscape and visual assessment in the Scottish context.

In accordance with the GLVIA, landscape and visual impacts are assessed separately. Landscape effects are the changes to the physical landscape (which is considered an environmental resource) and visual effects are the modifications to the views and how the landscape is experienced.

Both the landscape and visual assessments comprise an analysis of the baseline i.e. the current conditions likely to be present at the time the scheme is implemented and an assessment of the potential effects. As the four options under consideration are variations in the same location, generic landscape and visual baselines are provided. The assessments of potential effects are specific for each option and are described for each option (see sections 5.12 – 5.15).

For the classification of landscape value, the scale recommended by the Design Manual for Roads and Bridges (DMRB) Volume 11 has been used. The criteria on sensitivity and magnitude is taken from the Interim Supplementary Guidance to the DMRB Volume 11 on Landscape and Visual Assessment issued by The Scottish Executive (11/02/02).

The following sources of information have been used:-

- The Argyll and Bute Structure Plan 2002 (Approved November 2002);
- The Adopted Dumbarton District, District Wide Local Plan (March 1999);
- Loch Lomond and the Trossachs National Park Plan 2007-2012 (Adopted March 2007);
- Loch Lomond and the Trossachs National Park Consultative Draft Local Plan (November 2008);
- National Planning Framework (NPF);
- Scottish Planning Policy documents (SPP1 and SPP17) Scottish Planning Policy (SPP)(Parts 1 and 2 October 2008, Part 3 Consultative Draft April 2009);
- National Planning Policy Guideline (NPPG) 14 Natural Heritage;
- The Scottish Executive, 'Cost Effective Landscape: Learning from Nature';
- Consultation in relation to landscape and visual issues. (Scottish Natural Heritage and Loch Lomond and Troassachs National Park Authority); and
- Site visits on 31 July 2007 (Weather conditions: sunny, dry with clear visibility), 28 February 2008 (Weather conditions: wet, fair visibility) and 5 June 2009 – view from the Loch (Weather Conditions: sunshine and showers, clear visibility).

5.3.3 Baseline Conditions

5.3.3.1 Landscape Baseline

Designations

Pulpit Rock is located within a National Scenic Area and within the Loch Lomond and the Trossachs National Park. Pulpit Rock itself is a Scheduled Monument. It is Government policy to safeguard designated sites of national importance and to ensure that their natural heritage features are conserved and, where appropriate, enhanced. NPPG 14 states that development which would affect a designated area of national importance should only be permitted where:-

- The objectives and the overall integrity of the area will not be compromised; and
- Any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by social or economic benefits of national importance.

This approach is confirmed in the Scottish Planning Policy Consultative Draft April 2009. The National Planning Framework recognises the importance of Scotland's landscapes as a context for daily life, a tourist attraction, a setting for outdoor recreation and in defining Scotland's identity. The effect on landscape character will be an important consideration in

decision-making and the aim should be to build environmental capital and pass well-managed, high quality landscapes on to future generations.

The Loch Lomond and the Trossachs National Park Plan contains policies relating to conserving and enhancing the diversity and quality of the Park's landscapes which are described in Section 5.2 Policies and Plans. The current system of landscape designation is under review but the Authority continues to regard National Scenic Areas as being of exceptional quality.

Landscape Character

The National Park Plan contains extracts from the SNH Landscape Character Assessment which classifies the Pulpit Rock area as within the 'Highland Landscapes - Hills' Landscape Character Type. The forces for change don't relate to road development but the landscape objective is to conserve and enhance open upland landscapes while balancing biodiversity, cultural heritage and landscape benefits. The guidelines for achieving the landscape objective include promoting opportunities for small scale native woodlands and montane scrub in upland glens in association with landscape features while retaining a mainly open character.

The National Park Plan considers the historic and cultural dimensions to be an important aspect of the park's landscapes. The extracts from the SNH Landscape Character Assessment guidelines for historic landscapes recommend safeguarding important cultural remains and enhancing their landscape setting. Management plans and strategies for key historic landscapes should be prepared.

The site is located within landscape of the highest quality in Scotland and on the banks of Loch Lomond which is an iconic component of the Scottish landscape. The site comprises a large rock outcrop which juts out into the Loch. Pulpit Rock is a large free standing rock, adjacent to it, but set back a little. Pulpit Rock was, historically, used as a preaching site. Both the rock outcrop and Pulpit Rock form prominent and distinctive landscape features.

The landscape within the vicinity of Pulpit Rock is large scale and rugged. Loch Lomond is a long, relatively narrow loch located within a steep sided U-shaped glaciated valley with benches at higher levels and a variety of steep and more gentle slopes to the water's edge. The site is located towards the north end of the loch where it is surrounded by high ground and a number of summits on both sides. The land rises steeply to the west of the site to the summit of Ben Vorlich (943m). The higher ground is largely open moorland with rough grazing and rocky outcrops. The slopes are vegetated at lower levels with native woodland and scrub. There are large bands of coniferous forestry at higher levels. Various rock outcrops at lower levels form promontories which punctuate the Loch side.

The A82 skirts the banks of the Loch on the west side and along its entire length and the Glasgow to Fort William West Highland Railway Line runs at a higher level. Previous cuttings made into the rock outcrops adjacent to the Loch along its length to accommodate the road and railway construction are clearly visible from the water. Some of the cuttings have vegetated over but there are a number of large cuttings which appear as bare outcrops. Where the rock outcrops immediately adjacent to the banks there are some vertical or overhanging faces adjacent to the road. There are a number of prominent man made features on the banks of the Loch such as Victorian hotel developments and a very prominent hydro-electric scheme which forms an interesting feature.

The rock outcrop adjacent to Pulpit Rock forms a significant promontory into the Loch with vertical and overhanging faces. The A82 runs around the edge of the promontory at the loch side. The sloping faces of the rock outcrop are covered with mature vegetation and there is also mature vegetation growing on the Loch side of the road. There is a steep sloping stone rubble edge to the Loch that was originally built as a retaining structure for the road. The edge is not heavily engineered at this point and looks natural because natural materials have been used and colonisation by self seeding vegetation has taken place. The rock outcrop has already been cut back to accommodate the A82 and there is an old stone retaining wall adjacent to the west side of the road for part of the section around the promontory. The Glasgow to Fort William West Highland Railway Line runs at a higher level and curves to the south and west of Pulpit Rock.

The landscape setting of the pulpit was important to its use as a meeting place because the topography enclosed an open area where people could gather. Opinion is divided as to whether the site was selected for wide views, which would give a warning of approach from any direction (see section 5.7.4.2). The open setting of Pulpit Rock has been compromised by the growth of vegetation and also by the construction, in the Nineteenth Century, of the railway line to the south of the site.

- Value: Within the National Scenic Area - Highest Quality
- Sensitivity: Highly valued distinctive landscape - Very High

5.3.3.2 Visual Baseline

The A82 is one of the principal tourist routes in Scotland and is one of the few routes going north. It is also one of the principal viewpoints of the National Scenic Area.

The zone of visual influence is relatively restricted to the section of the valley within which the site is located. The land rises steeply behind Pulpit Rock and it is also situated to the north of a sharp bend which restricts views to the south. Views from the A82 to the north are also relatively restricted owing to the steep topography and bends in the road. However the site can be seen from a wide area from the Loch and opposite bank of Loch Lomond. It is visible from the West Highland Way, the long distance footpath, which runs along the east side of Glen Lomond and also from the hillsides to the tops of the hills which form this section of the east side of Glen.

As the A82 at this point runs through a rural area there are relatively few permanent receptors. The receptors, shown on *Figure 5.1* can be categorised as:-

- Residential receptors, including farms located within the zone of visual influence but not very near to the scheme (3 houses). There are no properties very close to the scheme. They have high sensitivity to visual change but their sensitivity varies with proximity to the route and is mitigated by the extent to which they are screened by vegetation and their orientation in relation to the site. These receptors overlook the route from medium range. The view from some of these properties is partially screened by vegetation. (Sensitivity: Medium);
- Travellers using the A82. This is by far the largest group of receptors and large numbers travel this route daily. Many of the travellers are tourists with high sensitivity to changes in their view of the landscape. These receptors experience the view from the road whilst moving but high speeds cannot be achieved owing to

the narrow road and tight bends. Also the location of traffic lights at Pulpit Rock means that a high proportion of travellers will stop and experience the view rather than getting a fleeting glimpse. (Sensitivity: High);

- West Highland Way walkers. The long distance footpath is a popular route within the National Scenic Area and has a significant number of users. Recreational receptors within the National Scenic Area have very high sensitivity because a principal reason for walking the route is to appreciate the landscape. However they view the site for a limited period of time as part of a wider changing view of the landscape. (Sensitivity: High);
- Loch users. Loch Lomond is a popular tourist location and is used for recreation such as sailing, fishing and canoeing. A number of visitors will view the site from craft using the Loch although the main tourist cruise boats operate further south. These recreational receptors also have high sensitivity as they are there mainly to enjoy the landscape. These receptors will also view the site for a limited period as part of a wider changing view of the landscape. (Sensitivity: High);
- Railway passengers using the Glasgow to Fort William West Highland Railway Line. The railway line skirts the south and west of Pulpit Rock at high level. Receptors using the railway will include a high proportion of tourist and recreational receptors with high sensitivity as they are there mainly to enjoy the landscape. These receptors will view the site for a limited period whilst travelling at speed as part of a wider changing view of the landscape. The view of the site is oblique and partially screened by vegetation. (Sensitivity: High); and
- Other recreational receptors. Walkers on the hills and mountains and campers. Recreational receptors within the National Scenic Area have very high sensitivity because the principal reason for being there is to appreciate the landscape. The view of the site is part of a wider changing view of the landscape. (Sensitivity: High).

There are no public viewpoints within the vicinity of the site to afford an overview of the options. An overview would be gained from the hilltops, particularly on the opposite side of the Glen, but the main vantage point is from the West Highland Way. The existing road is not lit.

5.4 Air Quality

5.4.1 Introduction

The current Air Quality section of the DMRB HA207/07 (issued May 2007) no longer includes Stage 1, 2 and 3 assessments. Instead, it focuses on a 'fit-for-purpose' approach based on four assessment levels:-

- Scoping;
- Simple;
- Detailed; and
- Mitigation/enhancement and monitoring.

For the purposes of this report the scoping procedure has been followed to determine if a further simple or detailed level of assessment is appropriate.

5.4.2 Assessment Methodology

The assessment is based on the determination of air quality impacts at the local and regional scale. At the local scale the assessment is based on a comparison of the number of residential properties located within 200m of the existing A82, each option and any surrounding affected roads. In addition, pollution levels at a selection of receptors are estimated to give an indication of the magnitude and significance of the change in pollution levels due to each option.

The local air quality study area covers a zone within 200m of the maximum extent of the existing A82 to be upgraded by any of the options, and all the options. Within this distance of a road, emissions from vehicles will affect air quality and, therefore, the level of pollutants. Beyond 200m, emissions will have dispersed sufficiently for concentrations to remain at background levels. To enable a 'like for like' comparison between the baseline and each option, the study area for the baseline and each option is identical. The various changes in traffic conditions listed in the DMRB, which cover changes in flows, composition and speeds have been used to determine if any surrounding roads will undergo a significant change. This process has identified that there are no surrounding roads predicted to undergo a significant change in traffic flow due to any of the options.

A check for residential properties that may be affected by emissions from traffic has been carried out for the existing A82 and each option. There are no properties within 200 m of the existing A82 or any of the proposed options, therefore an assessment of pollution concentrations is not required. However in order to provide some indication of pollution levels in the locality, pollution levels have been predicted at the closest properties to the north ([REDACTED] over 800m to the north) and south ([REDACTED] over 1400m to the south) of the scheme.

Pollution levels at the selected residential receptors have been predicted using the DMRB 'screening level' model (v1.03c). The results are compared to the current air quality objectives for Scotland.

DMRB also requires an assessment to be carried out at any nature conservation sites (designated sites) located in the local air quality study area. No designated sites (SACs, SPAs, pSPAs, SSSIs and Ramsar sites) have been identified in the 200m local air quality study area.

At the regional scale the assessment focuses on total annual pollution emissions. The DMRB sets a range of criteria regarding changes in traffic flows, composition and speed, which if met, requires an assessment of regional impacts. Based on the provided traffic data the change in average speed due to a number of the options meets the DMRB criteria. Therefore, total annual pollution emissions for the length of the scheme are predicted using the DMRB 'screening level' model (v1.03c). To enable a like for like comparison, emissions between the same start and end point on the A82 are calculated for the baseline and each option.

5.4.3 Baseline Conditions

Average annual mean background pollution levels in the study area for the current baseline year (2007) and the proposed year of opening (2011), from the UK Air Quality Information Archive, are provided in Table 5.4.1. The current Scottish air quality objectives are also provided to put the background levels in context.

Receptor	Year	NO _x µg/m ³	NO ₂ µg/m ³	PM ₁₀ µg/m ³	CO mg/m ³	Benzene µg/m ³	1,3 butadiene µg/m ³
[REDACTED]	2007	3.12	2.62	8.99	0.07	0.02	0.01
	2011	2.78	2.34	8.73	0.06	0.02	0.01
[REDACTED]	2007	3.28	2.75	9.00	0.07	0.02	0.01
	2011	2.93	2.47	8.73	0.06	0.02	0.01
Objective	-	40	-	40(18 [#])	<2 [*]	16.25 (3.25 [#])	2.25

Table 5.4.1: Annual Mean Background Pollution Levels

[#] Lower objective to be achieved by 2010

^{*} equivalent to the 8 hr running mean objective of 10 mg/m³

The background levels in the study area are very low and well below the current Scottish air quality objectives.

Local Authorities are required to periodically review and assess the quality of air in their districts, and its likely future quality, against the current air quality objectives. The latest Review and Assessment process undertaken by Argyll & Bute indicated that the air quality objectives for protecting human health would be met in all areas. As a result, no air quality management areas have been declared in Argyll & Bute. No air quality monitoring has been carried out by Argyll & Bute in the vicinity of the Scheme. The closest monitoring site is on the A82 at Tarbet, almost 10 km to the south of the Scheme. At this location NO₂ is monitored using diffusion tubes, in 2007 (the latest available data) the annual mean NO₂ concentration was monitored at 15 µg/m³.

A summary of the number of residential properties located within 200m of the existing A82 affected by the options is provided in Table 5.4.2. *Figure 5.2* illustrates the 200m study area for all the options.

Land Use	Distance Bands				
	0-50m	50-100m	100-150m	200-300m	TOTAL
Residential Properties	0	0	0	0	0

Table 5.4.2: Baseline Air Quality – Residential property count

The estimated pollution levels at the two selected receptors for the 2007 and 2011 baseline scenarios are given in Table 5.4.3, whilst *Figure 5.2* indicates the receptor locations.

Receptor	Year	NO ₂ µg/m ³	PM ₁₀ µg/m ³		CO mg/m ³	Benzene µg/m ³	1,3 butadiene µg/m ³
		Annual Mean	Annual Mean	No. days/yr 24hr mean > 50	Annual Mean	Annual Mean	Annual Mean
1: [REDACTED]	2007	3.76	9.27	<1	0.08	0.03	0.02
2: [REDACTED]	2007	4.61	9.51	<1	0.09	0.04	0.03
1: [REDACTED]	2011	3.23	8.92	<1	0.07	0.03	0.02
2: [REDACTED]	2011	3.92	9.09	<1	0.07	0.04	0.03

Table 5.4.3: Baseline Pollution Levels

Baseline pollutant levels are well below the air quality objective values for all pollutants at both receptors for both the baseline year, 2007, and the opening year, 2011.

The total baseline pollution emissions in 2007, 2011 and 2026 for traffic in the regional air quality study area are provided in Table 5.4.4.

Year	Tonnes/yr				
	CO	THC	NO _x	PM ₁₀	C
2007	0.80	0.11	0.66	0.02	52.36
2011	0.74	0.10	0.50	0.01	51.16
2026 [#]	0.83	0.12	0.44	0.01	57.15

Table 5.4.4: Baseline Total Annual Pollution Emissions

[#] Values calculated using 2026 data but with emissions factors for 2025, as this is the current limit of the DMRB Screening Tool

5.5 Traffic Noise and Vibration

5.5.1 Introduction

The current Noise section of the DMRB HA213/08 (issued August 2008) no longer includes Stage 1, 2 and 3 assessments. Instead, it focuses on a 'fit-for-purpose' approach based on four assessment levels:-

- Screening
- Scoping;
- Simple; and
- Detailed.

For the purposes of this report a screening and scoping level assessment has been carried out. In addition, in order to further illustrate the impact of the various options, traffic noise levels have been predicted at the closest identified receptor to the scheme.

5.5.2 Assessment Methodology

The objective of a screening assessment is to gather data to provide an appreciation of the likely noise and vibration consequences associated with the project. It involves determining if any of the following conditions are met:-

- The project alters the alignment of any existing carriageways;
- Traffic volumes on existing roads or new routes will increase by at least 25% or decrease by 20% either during construction or when the project is completed;
- Changes in traffic speed or the proportion of heavy vehicles on existing roads or new routes will cause a change in noise level of more than 1 dB(A) either during construction or when the project is completed; or
- Any changes to the infrastructure surrounding the road that could, when the project is completed, cause a change in noise level of more than 1 dB(A).

If any of the conditions are met the assessment should progress to the scoping stage. As all the options realign the existing A82, the assessment should progress to the scoping stage.

A scoping assessment involves the identification of residential properties and other sensitive receptors (community facilities, public rights of way and designated ecological areas) within 2 km of the scheme for rural schemes and 1km for urban schemes. The likelihood of noise and vibration impacts occurring at the identified receptors should be identified.

If adverse or beneficial changes in noise or vibration are considered likely at the identified receptors, the assessment should progress to the simple or detailed assessment stage.

The proposed scheme is classed as being in a rural location. Therefore, the study area of the screening/scoping assessment is 2 km in accordance with DMRB, and this radius is shown in *Figure 5.3*.

Potential noise and vibration sensitive receptors include:-

- Residential properties;
- Community facilities, including:-
 - schools,
 - hospitals,
 - places of worship,
 - sports facilities,
 - public open spaces including Scheduled monuments.
- Public rights of way including:-
 - footpaths,
 - bridleways,
 - byways.

- Designated ecological sites, including:-
 - National Parks,
 - AONB,
 - SPAs,
 - SACs,
 - SSSIs.

Residential properties are generally ranked as of high sensitivity to noise and vibration impacts. Community facilities, public rights of way and designated ecological sites are ranked as of medium sensitivity. Other land uses such as industrial and commercial uses are generally ranked as of low sensitivity. All the identified noise sensitive receptors are shown on *Figure 5.3*.

The assessment of the impact of a scheme is based on the magnitude of the change in traffic noise levels due to the scheme. DMRB outlines an example classification, see Table 5.5.1.

Change in Road Traffic Noise Level (Operation – Baseline) $L_{A10,18h}$ dB	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5+	Major

Table 5.5.1: DMRB Example Classification of Magnitude of Road Traffic Noise Impact

To enable a more detailed appreciation of the effects of the different scheme options, noise levels have been predicted for each of the options under examination. The traffic noise model is based on the following data and assumptions:-

- 2026 traffic data, 15 years after year of opening (18hr AAWT, % HGV and average speed);
- 1m ground contour data included, plus elevation line data for the existing road and each option;
- Ground absorption of 0.75 assumed throughout the study area, except for road surfaces which have a ground absorption of 0.0;
- Road surface type for all roads and options assumed to be stone mastic asphalt (correction = -1 dB for speed <75 km/h, = -3.5 dB for speed ≥75 km/h).

The SoundPLAN noise modelling software (v 6.5) has been used to predict the road traffic noise impact of each scheme option, SoundPLAN implements the standard 'Calculation of Road Traffic Noise' (CRTN) methodology. At the simple and detailed stages DMRB requires noise levels to be predicted for each noise sensitive receptor within 600m of the scheme extent. No residential properties have been identified within 600m of any of the options, the closest property is at [REDACTED] over 800m to the north. Only one receptor, namely Pulpit Rock Scheduled monument (SM), has been identified within 600 m of the scheme.

No residential properties are located within 40 m of the scheme, therefore, based on the guidance in the DMRB, a vibration impact assessment has not been carried out.

5.5.3 Baseline Conditions

The baseline noise levels at the Pulpit Rock SM have been predicted using noise modelling software. *Figure 5.3* illustrates the location of the Pulpit Rock SM. No baseline noise monitoring has been carried out.

The estimated free-field noise levels at the receptor for the 2026 scenario are presented in Table 5.5.2.

Receptor	Traffic Noise Level $L_{A10,18h}$ dB
	2026
1: Pulpit Rock SM	52.0

Table 5.5.2: Baseline Traffic Noise Levels

Figure 5.3 illustrates that the closest residential properties to the scheme are at [REDACTED] over 800m to the north, and [REDACTED] over 1400m to the south. A small number of other individual residential properties have also been identified in the 2 km study area, including a small number in the village of Ardlui on the A82 to the north.

No community facilities such as schools, hospitals, places of worship or sports facilities have been identified in the 2 km study area.

The West Highland Way footpath runs north-south along the eastern shore of the Loch approximately 500m east of the scheme. The scheme and the majority of the defined 2 km study area are located within the National Park, a SAC and SSSI are located along the eastern shore of the Loch. The Pulpit Rock SM is located a minimum of 55m from the A82 and the Island I Vow SM is located on an island in the Loch to the south east.

5.6 Land Use

5.6.1 Introduction

The quality of agricultural land affected was ascertained by investigating Soil Survey for Land Capability Mapping – Sheet 4, Western Scotland. Other land uses were identified by site visits and desktop studies.

5.6.2 Baseline Conditions

The primary land use along this section of the A82 between Tarbet and Ardlui is native woodland interspersed with areas of rough grazing. This semi-natural broad-leaved woodland is located immediately on either side of the A82 at Pulpit Rock (Clach Nan Tarbh). To the east of Pulpit Rock is the large freshwater body of Loch Lomond, and to the west the Glasgow to Fort William West Highland Railway Line and the mountainside of Ben Vorlich (943m), which is used for hill farming/rough grazing purposes, as well as for hillwalking and mountaineering purposes. The A82 is a trunk road that connects Glasgow and Fort William, and is the primary road in the Western Highlands. There is a rough access track between the A82 and railway line. Loch Lomond is used for a number of recreational activities such as

sailing, fishing and canoeing. Three small unnamed watercourses are located in the area (see section 5.10).

There are no residential or commercial receptors located within the study area. The nearest residential receptor is located approximately 1 kilometre to the north of Pulpit Rock.

There are telegraph poles and a line that run adjacent to the A82 on the loch side. There is a road lay-by at the northern extent of the Scheme study area.

5.6.2.1 Agricultural Land

Volume 11 of DMRB (Section 3, Part 6) recommends that the assessment should give an appreciation of the likely consequences of land take on agricultural land.

Rough grazing is present on the slopes above the woodland and within woodland glades. The Agricultural Land Classification (ALC) System devised by the Macaulay Institute classifies land into seven grades:-

- 1) Very Wide Range of Crops
- 2) Wide Range of Crops
- 3.1) Moderate Range of Crops – Above Average Yields
- 3.2) Moderate Range of Crops – average Yields
- 4) Narrow Range of Crops
- 5) Used as Improved Grassland
- 6) Used Only as Rough Grazing
- 7) Very Limited Agricultural Value

The “best and most versatile (BMV) land” is classified as Grades 1, 2 and 3(1) – this is the land which is most flexible, productive and most likely to deliver future crops. A desktop assessment shows that the soil type for this area is brown rankers, brown forest soils; some humus iron podzols and gleys. This soil type falls into Grade 6(1), which is land capable of use only use rough grazing, and falls outside the BMV land.

The field and land boundaries in the Scheme study area are generally wire and post fencing with some boundaries formed by woodlands, and drainage watercourses. The majority of land immediately surrounding the A82 at Pulpit Rock is generally unsuitable for agricultural purposes due to the steep contours, rock outcrops, and existing trees and mature vegetation.

5.7 Archaeology and Cultural Heritage

5.7.1 Planning and Legislative Context

5.7.1.1 Introduction

Cultural heritage resources form key components of Scotland’s historic environment, and include Scheduled Monuments, other archaeological features, listed buildings and other

buildings of architectural or historic interest, conservation areas, and historic gardens and designed landscapes and world heritage sites.

The following sections provide information on the legislative and planning policy framework designed to protect these cultural heritage resources. Planning policy is stated by reference to the Argyll and Bute Structure Plan, approved November 2002 and the Loch Lomond and the Trossachs National Park Plan approved March 2007). Historic Scotland's overall approach to the sustainable management of the historic environment is set out in its document Passed to the Future (2002). The Argyll and Bute Structure Plan (November 2002) recognises the need to protect, conserve, enhance and positively manage the historic environment. Under STRAT DC 9 it states that any 'development that damages or undermines the historic, architectural or cultural qualities of the historic environment will be resisted'. This is particularly in relation to Scheduled monuments, Listed Buildings or their settings or other architectural sites of national or regional importance, Conservation Areas and Historic Gardens and Designed Landscapes.

The Loch Lomond and the Trossachs National Park Plan (March 2007)

Policies that are relevant to the A82 Pulpit Rock proposal are as follows:

- **Policy CH1 Caring for our Cultural Heritage** (A strategic approach will be taken to conserving and enhancing the cultural heritage of the Park)
- **Policy CH2 Caring for Archaeology Sites, Settings and Landscapes** (Archaeological sites, their settings and landscapes will be protected and managed)

The National Park Authority will play a key role in this - both as the planning authority and in working proactively in partnership with others.

This document states that The National Park Authority, as the Planning Authority for the area, will prepare a Local Plan to complement the National Park Plan, setting out more detailed land-use planning policies relating to the historic environment, which will guide all development control decisions in the National Park.

5.7.1.2 This Loch Lomond and the Trossachs National Park Consultative Draft Local Plan (November 2008)

The plan contains several policy proposals which are material considerations for the A82 Pulpit Rock scheme:-

- **Policy ENV21 Listed Buildings** (Development affecting a listed building or its setting will preserve the building, or its setting or any features of special architectural or historical interest which it possesses.)
- **Policy ENV23 The Wider Built Environment and Cultural Heritage of the Park** (Where applicable development proposals will be expected to protect, conserve and/or enhance a building or feature of architectural and/or historical merit or of cultural significance. Any adverse impacts of a development should be avoided or mitigated.)
- **Policy ENV25 Scheduled monuments and Candidate Scheduled monuments** (Scheduled monuments will be preserved in situ within an appropriate setting and

development will not be permitted which adversely affects scheduled monuments or their settings.)

- **Policy ENV26 Other Unscheduled Sites of Archaeological Importance**
(Unscheduled archaeological heritage will be expected to be retained, protected and preserved in situ in an appropriate setting.)

5.7.1.3 Scheduled monuments

Under the Ancient Monuments and Archaeological Areas Act 1979 (1979 Act) the Scottish Ministers are required to compile and maintain a Schedule of monuments considered to be of national importance. The statutory consent of the Scottish Ministers is required before any works are carried out which would have the effect of demolishing, destroying, damaging, removing, repairing, altering, adding to, flooding or covering up a Scheduled monument (SM). A formal process of application to conduct such works (known as Scheduled Monument Consent) is administered on behalf of the Scottish Ministers by Historic Scotland. Effects of proposed development works upon the setting of a SM form an important consideration in the granting or refusal of planning consent to conduct development works. Further information on development control procedures relating to SMs is provided in National Planning Policy Guideline 5, Archaeology and Planning (NPPG 5) and Planning Advice Note 42, Archaeology (PAN 42).

Other Archaeological Sites and Monuments

Archaeological sites and monuments without statutory protection are curated by the local planning authority. NPPG5 and PAN 42 provide national planning policy guidance and advice on the treatment of this resource. PAN 42 indicates that the principle that should underlie all planning decision-making is preservation of cultural resources, in situ where possible, and by record if destruction cannot be avoided. The document acknowledges that preservation may not always be possible, and where damage is unavoidable various mitigation measures may be proposed.

Listed Buildings

Under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (1997 Act), the Scottish Ministers are required to compile a list of buildings of special architectural or historic interest. Such buildings are classified into Categories A, Ba and c(s), in decreasing order of importance. Sustainable development is the principle underlying Government policy towards the historic environment. There is a presumption against development that will adversely affect the character of a listed building or its setting and planning authorities and the Scottish Ministers are required to have special regard for the desirability of preserving listed buildings or their settings and any features of special architectural or historic importance they possess.

5.7.2 Assessment Methodology

5.7.2.1 Collation of Baseline Data

Up-to-date information was obtained from appropriate sources on the locations and extents of recorded cultural heritage sites within or close to the proposed development site.

Details of the locations and extents of Scheduled monuments, Listed Buildings and Historic Gardens and Designed Landscapes within 1km of the centreline of the road were obtained from Historic Scotland (see Figure 5.1).

Information on Conservation Areas and other historic townscape designations was obtained from the Local Plan whilst the Loch Lomond and the Trossachs National Park Consultative Draft Local Plan (November 2008) was referred to as a relevant material consideration.

Information on other non-designated sites within 200m of the centreline of the road were obtained from the National Monuments Record of Scotland (NMRS) and their online database Pastmap (www.pastmap.org). The West of Scotland Archaeology Service Sites and Monuments Record (SMR) was also consulted.

Historic Scotland and West of Scotland Archaeology Service (WoSAS) were consulted. The results of the consultations are summarised in Table 5.7.1:

Consultee	Date of Response	Response
Historic Scotland	22 March 2007	<p>Noted that their response was concentrated on Historic Scotland's statutory remit at the National Level for; Scheduled Monument; Listed Buildings; Historic Gardens and Designed Landscapes.</p> <p>Noted that details of historic environment resources of regional or local importance need to be sought from the West of Scotland Archaeology Service.</p> <p>Advised of the presence of one Scheduled Monument close to the proposed road improvements: Pulpit Rock, preaching site, south of Ardlui (index no. 10792).</p> <p>Advised that no ground disturbance should take place within the scheduled area, and if possible within a 20m zone outwith the scheduled area. A copy of the monument schedule showing the extent of the area was supplied.</p> <p>Supplied details of how best to protect this area during ground investigation works.</p> <p>Provided an interpretation of the setting of Pulpit Rock.</p> <p>Noted that the retention of a similar (or greater) degree of open aspect to the N and NE of the Pulpit Rock and the retention (or alternative provision) of safe public access to the site would be desirable in the final design.</p>
West of Scotland Archaeology Service (WoSAS)	5 July 2007	<p>Noted that, aside from the Pulpit Rock, they did not have any archaeological sites recorded in the area that would be affected by the proposed upgrade works.</p> <p>Noted that the Pulpit Rock was scheduled and that Historic Scotland should be contacted regarding this site.</p> <p>Noted that the proposed road improvements may have the potential to disturb or destroy the Pulpit Rock and that the aim of any assessment should be to minimise the impact of the development on the monument and ensure its long term survival within an appropriate setting.</p> <p>Noted that, due to artificially high water levels, there is a potential for unrecorded Crannogs to be present around the shores of the Loch and that, consequently, any proposals to build out in to the loch could disturb or destroy such sites.</p> <p>Recommended that any survey of the loch floor adjacent to Pulpit Rock undertaken as part of the feasibility study should also attempt to identify whether Crannogs are present below the current water line.</p>

Consultee	Date of Response	Response
West of Scotland Archaeology Service (WoSAS)	4 October 2007	<p>Provided SMR data as requested.</p> <p>Noted that the line of the Tarbet to Crianlarich Military Road may be affected by the works.</p> <p>Repeated concerns over the effect of the various proposals on Pulpit Rock.</p> <p>Repeated concerns about previously unrecorded Crannogs but conceded that that the form of the land at this particular point may be too steep for Crannogs to be present.</p>

Table 5.7.1: Cultural Heritage Consultations Undertaken

5.7.2.2 Reconnaissance Survey

Reconnaissance field survey was undertaken to assess the baseline conditions of the sites, monuments and landscape features identified by the desk-based assessment; to assess the settings of key built heritage resources; and to assess the topography, geomorphology and land use of the proposed development area to aid the assessment of its archaeological potential. It was not the purpose of this survey to identify previously unknown sites; this will be carried out for the Environmental Statement.

5.7.3 Baseline Conditions

5.7.3.1 General

Three cultural heritage sites have been identified within the assessment area (and are shown on *Figure 5.1*). [Appendix A1](#) provides detailed information on the character and baseline condition of each site.

The four archaeological and heritage sites are:-

- 2 Scheduled Monuments, one of which is also a Listed Building;
- 1 undesignated site of archaeological interest.

Reconnaissance survey demonstrated that the line of the Tarbet to Crianlarich Military Road follows the line recorded in the WoSAS SMR (*Figure 5.1*) and that Pulpit Rock survives as described in the scheduling documents. Island I Vow was not visited.

5.7.3.2 Scheduled Monuments

There are two Scheduled Monuments within c.1km of the centreline of the road.

Study Number	Name	Grid Reference
1	Pulpit Rock, preaching site, south of Ardlui (Index No 10972)	NN 3262 1362
2	Island I Vow, Castle and Settlement, Loch Lomond (Index No 11073)	NN 3313 1273

Table 5.7.2: Scheduled Monuments

5.7.3.3 Listed Buildings

There is one Category B Listed Building within c.1km of the centreline of the road.

Study Number	Name	Grid Reference
3	Loch Lomond, Island-I-Vow, Castle (No 821). Category B	NN 3313 1273

Table 5.7.3: Listed Buildings

5.7.3.4 Non-Statutory Sites

There is one non-statutory site within 200m of the centreline of the existing road.

Study Number	Name	Grid Reference
4	Tarbet to Crianlarich. Military Road	NN 3257 1360 to 3231 1393

Table 5.7.4: Undesignated Sites

5.7.3.5 Archaeological Potential of the Study Area

On the loch side of the road the ground mostly drops away sharply down to the water edge which had been reinforced in places with rip-rap protection. The covering vegetation is naturally seeded birch and scrub undergrowth. On the landward side of the road at the south-eastern end of the proposed improvements the landform is dominated by a flat topped hill with steep sides down to the road. The slopes of the hill are covered with naturally seeded birch trees. The area around the Pulpit Rock is a flat poorly drained area of rough grazing with a broad poorly drained verge between the enclosed area and the current road line.

Given the topography and the impact of modern development the archaeological potential for the majority of the scheme area is considered to be low. However, the summit of the hill above the current road is a topographically prominent location and locations like this are known from the archaeological record elsewhere to have been used in the past. Whilst there are no earthworks or surface traces to suggest such use, it is possible that buried remains are present and, thus, this area is considered to be of moderate archaeological potential.

The hydrographic survey adjacent to the proposed improvements indicates that the loch side slopes steeply downwards and that it is unlikely given this topography that this immediate area would be suitable for the construction of Crannogs.

5.7.4 Cultural Heritage Issues for the Baseline Conditions

Cultural heritage issues that might arise from the road improvements would potentially relate to the known sites, which include two Scheduled Monuments (one of which is also a Listed Building) and an undesignated site, and to the potential to discover hitherto unrecorded archaeological remains.

5.7.4.1 The Castle on Island-I-Vow

The Castle on Island-I-Vow is a Scheduled Monument and a Category B Listed Building. The site's Scheduled designation takes precedence in terms of the level of protection it is accorded. Its baseline setting is provided by Loch Lomond and the existing A82. The road improvements would be carried out on a stretch of the A82 around 1km to the north-west of the island. A slight promontory, known as Rubha Ban (*Figure 5.1*) would lie between the island and the zone of road improvements. Thus, none of the options for the road

improvements would have an effect on the setting of this site and it is not considered further in this report.

The site is not mentioned in Historic Scotland's consultancy response of 22 March 2007.

5.7.4.2 Pulpit Rock

The preaching site known as Pulpit Rock is a Scheduled Monument. The scheduling incorporates the rock and a level area to the immediate east within which the congregation would have been gathered. Historic Scotland in their letter of 22 March 2007 state that:

"The monument was sited here because of the natural rock topography and because there is an open slope with wide views, which would have given warning of approach from any direction. Ease of access along the loch shore and by water would also have been significant. The construction of the railway line embankment in the nineteenth century has compromised the landward setting, but the relatively open aspect towards the N and NE is still evident, although there are trees which restrict the views at present.

"In considering design/engineering solutions, retention of a similar (or greater) degree of open aspect to the N and NE and the retention (or alternative provision) of safe public access should be treated as extremely desirable objectives".

Pulpit Rock became a preaching site after locals, mainly shepherds, in the northern part of Arrochar parish complained to the Rev Peter Proudfoot, their minister about the eight-mile walk to and from their Sabbath devotions. The religious services conducted at Pulpit Rock were not of any heretic nature and did not need to be conducted in secret; there was, therefore, no need for the congregation or minister to be able to disperse rapidly from what were perfectly normal ceremonies. There are no known associations with earlier religious observances.

The present-day baseline setting of Pulpit Rock includes the current A82. The preaching site at Pulpit Rock was formed by quarrying in 1825, post-dating Caulfeild's Military Road, which dates from the mid-18th century. Thus, there has always been a road between Pulpit Rock and Loch Lomond. When in use, the focus of the preacher would have been on the congregation on the flat ground immediately to his east and the focus of the congregation would have been on the preacher in the pulpit to their west.

The potential effects of the road improvement options have to be assessed with this baseline setting in mind.

5.7.4.3 Tarbet to Crianlarich Military Road

The Tarbet to Crianlarich Military Road was constructed in the mid-18th century and follows the line shown on *Figure 5.1*. Reconnaissance survey revealed that it survives as a terrace and causeway c.5m wide, as described in the WoSAS SMR for the stretch between NN 3257 1360 and NN 3231 1393. If a road improvement option intersected with the course of the Military Road, the resultant predicted direct impact would have to be mitigated by a programme of archaeological excavation to an agreed scope of works.

5.7.4.4 Hitherto unrecorded archaeological remains

The archaeological potential of the area within which the road improvement scheme would be located is considered generally to be low. WoSAS have suggested the possibility that unrecorded crannogs are present along the fringes of Loch Lomond in two letters (5 July 2007 and 4 October 2007). The hydrographic survey adjacent to the proposed improvements indicates that the loch side slopes steeply downwards and hence would have been unsuitable for the construction of crannogs.

It is possible that a programme of archaeological mitigation works could be required, which could comprise of trial trenching evaluation in advance of development and/or a watching brief during development.

5.8 Ecology and Nature Conservation

5.8.1 Introduction

The objective of DMRB Volume 11 (Section 3, Part 4) in relation to nature conservation is concerned with maintaining a viable population of the country's characteristic fauna and flora and the communities they comprise. This objective can be achieved as follows:-

- The maintenance of the diversity and character of the countryside, including its wildlife communities and important geological and physical features;
- The maintenance of viable populations of wildlife species, throughout their traditional ranges, and the improvement of the status of rare and vulnerable species.

The requirement for Stage 2 assessment is "to undertake sufficient assessment to identify the nature conservation factors, and the significance of effects upon them, to be taken into consideration by the Design Organisation in developing and refining the route options".

5.8.2 Assessment Methodology

This assessment has been based on current best practice outlined in legislation and planning policy (e.g. NPPG 14 Natural Heritage), incorporates many of the principles set out in the guidance for ecological impact assessment developed by a working group of the Institute of Ecology and Environmental Management (IEEM) (IEEM, 2006) and is based on guidance set out in DMRB Volume 11.

Baseline information has been compiled by detailed desktop research compiling information from a number of sources. Information regarding species status and key environmental schemes and designations of relevance to the site was gained through consulting the Argyll & Bute Biodiversity Action Plan (BAP), the UK BAP, the Loch Lomond and Trossachs National Park Plan, the Scottish Natural Heritage (SNH) Sitelink website and the Forestry Commission Land Information Search website. Sites deemed of relevance were those within 2km of the site boundary for statutory designated sites, and within 500m for non-statutory sites and features. The National Biodiversity Network (NBN) Gateway website was consulted to provide baseline information on protected species records close to the site area. An initial consultation was carried out with Darren Hemsley, SNH Area Officer, Stirling and Argyll (letter: 5th March 2007) and the ecological scope was determined.

Ecologists carried out habitat and protected species surveys during April-September 2007. Additional surveys were undertaken on 3rd and 4th June 2009 in order to update previous work, particularly for otter, bat and invasive species. The Loch Lomond Fisheries Trust (LLFT) was employed on a sub-consultancy basis to undertake fisheries surveys. Some surveys deemed appropriate for updating will be repeated as the assessment period progresses. Surveys concentrated on the following:-

- Phase 1 Habitat Survey;
- Aquatic macrophyte (plant) surveys;
- Fisheries surveys;
- Breeding Birds (3 Common Bird Census (CBC) visits);
- Otters;
- Water Voles;
- Red Squirrels;
- Badgers;
- Wildcat; and
- Bat roost potential plus dawn re-entry surveys.

Consultations with statutory and non-statutory consultees have been carried out to inform the scheme assessment process. Further consultation will be carried out with other organisations during the next stages of the assessment process. Organisations consulted to date are:-

- Loch Lomond and the Trossachs National Park Authority (LLTNPA);
- Loch Lomond Fisheries Trust (LLFT);
- Scottish Natural Heritage Area Officer; and
- Scottish Environment Protection Agency (SEPA).

5.8.3 Baseline Conditions

5.8.3.1 Statutory Designated Sites

Ben Vorlich Site of Special Scientific Interest (SSSI) is located within 1km to the west of the A82 at its nearest point. It is of biological interest regarding its upland habitat, being the highest hill in the District of Argyll & Bute.

Loch Lomond Woods Special Protection Area (SAC) is located on the opposite shore of Loch Lomond and is designated for Broad-leaved, mixed and yew woodland and also for the presence of Otters. Pollochro Woods SSSI is also located on the opposite shore of Loch Lomond on steep westerly facing slopes. It is an extensive area of semi-natural woodland, most of which is classified as ancient.

5.8.3.2 Non-Statutory Designated Sites

There are two areas of woodland classified as ancient semi-natural woodland on the SNH Ancient Woodland Inventory (AWI), both of which are more than 400 metres from the scheme boundary at their nearest points, one site being on the opposite shore of the Loch.

5.8.3.3 Habitats

The main habitats within the study area include semi-natural broadleaved woodland, which varies in character throughout the study area. It is generally dominated by downy birch (*Betula pubescens*), alder (*Alnus glutinosa*) and oak (*Quercus* sp.) with an understorey comprising common bent (*Agrostis capillaries*), sweet vernal grass (*Anthoxanthum odoratum*), scattered rowan (*Sorbus aucuparia*) and hazel (*Corylus avellana*) saplings with bramble (*Rubus fruticosus* agg.) and bracken (*Pteridium aquilinum*). Some areas have diverse herb assemblages and rare liverwort and fern species, dense scrub including bramble, young alder and hazel saplings, continuous bracken, unimproved grassland dominated by common bent, sweet vernal grass, heath bedstraw (*Galium saxatile*) and tormentil (*Potentilla erecta*), marshy grassland, mainly around Pulpit Rock itself, natural rock exposures colonised by ericaceous vegetation and a good bryophyte community and a stretch of the north western shores of Loch Lomond comprising aquatic macrophyte assemblages.

There are two stands of Japanese knotweed (*Fallopia japonica*) within the survey corridor.

See [Appendix A2](#) for more detail on the habitats present within the scheme footprint.

5.8.3.4 Protected Species

Surveys for badger (*Meles meles*), red squirrel (*Sciurus vulgaris*), water vole (*Arvicola terrestris*), wildcat (*Felis sylvestris*), amphibians and reptiles were conducted on 7th June 2007. No signs of these species were found within the scheme footprint, and an assessment of the habitat suitability concluded that its use by these species is very unlikely, and they are not considered further within the options assessment. See [Appendix A2](#) for detailed legislative background and further survey details for these species.

Otters (*Lutra lutra*)

Otter surveys were conducted on the 19th April 2007, 7th May 2008, 7th June 2008 and 4th June 2009. These will be continually updated during site visits throughout the scheme assessment period to monitor otter use of the scheme footprint.

Suitable otter habitat exists along the full stretch of the site in the form of the well-vegetated Loch side. There is a small burn that enters the Loch to the north of the northern traffic lights. During survey visits several fresh and old otter spraints were found along the Loch side, spanning from the northern stretches of the site to the south.

A heavily sprainted site directly beneath the southern traffic lights, is a suspected otter lying up site, with several cavities in the rocky embankment shelving into the Loch being big enough to allow otters to rest in. Spraints have been recorded outside several of these cavities on numerous occasions suggesting frequent use. With regard to this likely otter shelter, licensing procedures must apply. See [Figure 5.1](#) for locations of otter signs and [Appendix A2](#) for detailed legislative background and further survey details for otters.

Bats

A number of mature trees with features suitable for roosting bats, were recorded during protected species surveys in June and September 2007 and June 2009. The locations of the trees and potential features suitable for roost sites include:-

- Between the northern traffic lights and the northern end of the survey area (2-3 mature ash (*Fraxinus excelsior*) trees showing cracks and crevices);
- Several mature oaks throughout the site (e.g. the area between the traffic lights, to the south of the traffic lights, and to the immediate north of the traffic lights);
- A mix of silver birch (*Betula pendula*), oak and ash to the west of the road may also serve as foraging habitat;
- Far to the south of the survey area is a very mature alder developing rot holes and broken boughs.

Dawn re-entry surveys were conducted in September 2007 focusing around trees with bat roost potential. No bats were observed emerging from or entering trees but several passes were detected from common pipistrelle (*Pipistrellus pipistrellus*) and soprano pipistrelle (*Pipistrellus pygmaeus*). Surveys carried out during June 2009 using an Anabat bat detector recorded the presence of three bat species and a total of 269 bat passes at locations on the loch shore and in the woodland between the road and the loch shore. See *Figure 5.1* for locations of bat signs and [Appendix A2](#) for detailed legislative background and further survey details for bats.

Breeding Birds

Bird surveys based on the Common Bird Census (CBC) were carried out on three occasions between April and June 2007 and further surveys were carried out during June 2009 in order to identify and locate breeding bird species within 100m of the route corridor. The species recorded were mainly common woodland species, including two species listed in the UK Biodiversity Action Plan (BAP) – redpoll (*Carduelis cabaret*) and tree pipit (*Anthus trivialis*) and one species on the Argyll & Bute LBAP – song thrush (*Turdus philomelos*). Six species found on site are listed as Red Status (high conservation concern) on the JNCC / BTO Birds of Conservation Concern list (BoCC). These species are bullfinch (*Pyrrhula pyrrhula*), song thrush, spotted flycatcher (*Muscicapa striata*), wood warbler (*Phylloscopus sibilatrix*), cuckoo (*Cuculus canorus*) and tree pipit (*Anthus trivialis*). See [Appendix A2](#) for detailed legislative background and further survey details for breeding birds.

It is important that any removal of trees and scrub is programmed to avoid the breeding bird season (March to August) or conducted under the supervision of an appropriate specialist.

Fish

Following initial walkover surveys and consultation with SNH and the Loch Lomond Fisheries Trust (LLFT) it was decided that adequate fisheries data should be collected to determine the location of habitats important to Atlantic salmon (*Salmo salar*), lamprey (*Lampetra* spp.), or powan (*Coregonus lavaretus*) which are present adjacent to the scheme. These surveys were conducted between April and June 2008.

The fish survey showed that the principal fish species present in the Pulpit Rock area are ruffe, roach and perch. However, there is a powan population present. Habitat in the

immediate area of Pulpit Rock is of poor quality and is generally unsuitable for powan spawning or as lamprey nursery habitat. However, lamprey nursery habitat is present mainly to the north of the area at some distance (>15-20 m) from the shore where some lamprey ammocoetes are present. There is high quality powan habitat located at the southern extreme of the study area towards Rubha Ban, 500 metres south of Pulpit Rock (grid reference NN 33000 13250). This is a known spawning site and the steeply shelving nature of the littoral zone in the upper basin means that such sites are limited in northern Loch Lomond and this site should be regarded as being of particular importance. Furthermore, 2 adult powan were captured during gill netting in Loch Lomond in an area adjacent to Pulpit Rock. This is further evidence that this area is important to this species and that a population remains present. Suitable powan spawning habitat is also present in close proximity to the shoreline immediately north of Pulpit Rock (grid reference NN2324 7138) however, no evidence of Powan spawning activity was recorded in this area at the time of survey.

Recommendations to protect fish comprise the following:-

- Protection of powan spawning areas to the south of Pulpit Rock should be the highest priority;
- The extent of powan spawning along the shoreline to the north should be ascertained from further surveys at spawning time;
- The importance of the lamprey nursery habitats to the north should be further investigated; and
- The small burn which enters the loch will be affected by the road development. This watercourse should be electro-fished to establish if it is a nursery stream for salmonids.

See [Appendix A2](#) for detailed legislative background.

5.9 Pedestrians, Cyclists, Equestrians and Community

5.9.1 Introduction

The consideration of the pedestrians, cyclists, equestrians and community effects directly associated with the proposed A82 Pulpit Rock Improvement options has been undertaken in accordance with DMRB Volume 11 (Environmental Assessment) - Stage 2.

The objective of the Stage 2 assessment “*is to undertake sufficient assessment to identify routes used by pedestrians and others, the community facilities and the effects upon these two categories to be taken into account by the Design Organisation in developing and refining route options, in agreement with the Overseeing Department’s Project Manager*”.

(Source DMRB Vol 11: Section 3 – Chapter 9)

The assessment of the pedestrians, cyclists, equestrians and community effects is aimed at helping inform the decision regarding a preferred Improvement Option to be taken forward for more detailed assessment at DMRB Stage 3.

5.9.2 Assessment Methodology

The assessment embraces a number of key considerations for existing receptors contained within, and, in proximity to, the proposed A82 Pulpit Rock Improvements. The “checklist” of community effects considered within this chapter include:-

- Permanent or temporary restriction of access or severance of access to residential, community and other civic facilities;
- Permanent or temporary loss/closure of community or civic facilities;
- Permanent or temporary restriction of access or severance of access to commercial properties;
- Permanent or temporary closure of commercial properties;
- Permanent or temporary severance of public recreational routes e.g. cycleways, existing public Rights of Way (RoW)/proposed core path routes, bridleways etc; and
- Scheme impacts on existing local vehicular journey routes.

The Stage 2 consultation requirements as contained within DMRB Vol 11 Section 3 Chapter 9 (Part 8) are not particularly prescriptive but do require that consideration of the route options at this stage should not lead to unnecessary anxiety amongst local people and “members of the public should not therefore be asked for information on usage of community facilities, nor should origin/destination surveys be undertaken”. The Stage 2 consultation guidance only calls for consultation with the local highways officer responsible for cycling provision “where cyclists will be significantly affected”. Given that there is currently specific provision for cyclists at Pulpit Rock (a cyclist operated “push button” facility on both sets of traffic lights), it was decided by Scott Wilson and Transport Scotland to contact Argyll & Bute Council, Sustrans, and CTC Scotland in order to establish:-

- Any relevant baseline information e.g. the current provision for cyclists on the section of the A82 that includes Pulpit Rock that should be taken into account when developing the scheme improvement options;
- Known proposals (or aspirations) for the provision/enhancement of cycle route provision in the area e.g. on the section of the A82 that includes Pulpit Rock;
- Any concerns that the consultees may have about the scheme from a cycling provision perspective; and
- Any issues that the consultees would like to see included in the Stage 2 Report and subsequent environmental assessments.

These approaches were in addition to a previous consultation approach made to the Loch Lomond & the Trossachs National Park Authority (LLTNPA) for baseline information and comments in respect of cycling on the A82 and boating and navigation on Loch Lomond in proximity to the A82 Pulpit Rock scheme. A summary of the consultation responses is included in Table 5.9.1 below.

Consultee	Consultee Response Summary
<p>Sustrans (Jack Hunt - Land Manager : Scotland)</p>	<p>Sustrans is aware that the LLTNPA have identified Tarbet-Crianlarich as a strategic off-highway route line, to make up a critical gap in the Park wide network of routes and Sustrans works in partnership with the LLTNPA.</p> <p>Sustrans notes that the Trunk Road Initiative offers scope to create improvements to cater for all road users (including cyclists) at time of new trunk road works.</p> <p>Sustrans state that on balance it would seem most appropriate to maximise the width of surfaced verge retained outwith the solid white road edge markings of the trunk road carriageways - whether the new road section is built in tunnel, on deck or through rock.</p> <p>Sustrans suggests that this width be maximised to achieve 2m unrestricted bitmac of the same surface as the new road itself, and free of drainage chamber heads, infill and other hazards, on both east and west sides of the new carriageways.</p> <p>This 2m surfaced road edge could be surfaced in bauxite chip to highlight its' purpose and status and to dissuade parking by public and roads service and maintenance vehicles. If reduced to be narrower than 2 metres, the edge route would not offer sufficient physical sanctuary from road traffic.</p> <p>A degree of better segregation could be provided by a raised verge strip rather than a stone drain infill which is not a good means of segregation, since dislodged infill would soon obstruct the cycle route.</p>
<p>Argyll & Bute Council Development Services – Transportation & Infrastructure (Nicola Debnam - Transport Policy)</p>	<p>A&BC does not hold any cycling baseline information relevant to the study – only the previous Route Action Plan and the Economic Appraisal.</p> <p>The Council's aspiration has long been to achieve an acceptable road width (6m as an absolute min. – preferably 7.3m as Highway Link Design states) along the entire route (A82) with a one metre edge strips and formed verges. At pinch points in the network this would at least improve conditions for walkers and cyclists.</p> <p>The Council highlighted the Sustrans regional cycle route from Balloch to Tarbet (Route 40) and stated that it should be considered that walkers /cyclists may wish to continue on the A82 from this point (Tarbet). The Council also believes that access from the A82 to the various train stations on the route should be as easy as possible.</p> <p>The only concerns that A&BC have about the A82 Pulpit Rock Improvements scheme would be that “adequate/safe” facilities are provided for cyclists (and walkers) whilst the Council did not identify any other issues “at the moment” that should be considered in the Stage 2 Report and subsequent environmental assessments.</p>
<p>CTC Scotland (Glasgow District Association – Willie Dickson)</p>	<p>No consultation response received</p>
<p>LLTNPA (Carron Tobin – Executive Director and David Harrison – Principal Planning Officer)</p>	<p>No formal response received – but views from the LLTNPA provided at the various Scheme Workshops which have been held during the study.</p>

Table 5.9.1 – Consultee Responses

5.9.3 Baseline Conditions

The following sections provide a comprehensive baseline description of the pedestrians, cyclists, equestrians and community facilities within, and immediately adjacent to the scheme location. These facilities are illustrated on *Figure 5.1*.

5.9.3.1 Pedestrians

There is no baseline dedicated footpath provision for pedestrians at Pulpit Rock. Indeed the nearest sections of road-side foot path provision are at Ardlui (c.2km north of the site) and at Sloy Power Station (c.4.8km south of Pulpit Rock). Between these two locations, pedestrians are obliged to use the A82 verges for road-side walking with no physical separation from vehicular traffic.

It would appear that there are no Rights of Way (RoW) at, or in, the immediate vicinity of Pulpit Rock (*this would be confirmed during the Stage 3 assessment consultations with the Scottish Rights of Way Society*). In the wider area around Pulpit Rock there is a route to the top of Ben Vorlich commencing next to Ardlui railway station (for “serious and skilled walkers/climbers”). For less experienced walkers there is another route to Ben Vorlich starting from Sloy Power Station (*Source -www.loch-lomond.net/villages/ardlui/ardlui.html*). However, neither route passes Pulpit Rock.

As summarised in the later “Ferry Services” section, seasonal foot ferry services across Loch Lomond from Inveruglas (to Inversnaid) and Ardlui (to Ardluish) provide a link for walkers to connect with the West Highland Way long distance walking route which extends up the east side of Loch Lomond from north of Balmaha.

In addition, it is appropriate to highlight the fact that a significant part of the land (and inland water) in the vicinity of the scheme will be affected by the Land Reform (Scotland) Act 2003 legislation. Under the Act, the LLTNP - as the access authority - has a statutory requirement to produce a Core Paths Plan to cover its administrative area. The Core Paths system is required to cater for all types of users e.g. walkers, cyclists, horse riders etc.

The Loch Lomond & the Trossachs National Park Core Paths Plan was published as a Consultation Draft document on 5 May 2008. The Draft Plan sets out a basic network of core paths that have been identified as being sufficient to meet the needs of local people and visitors for recreational purposes and for local movement (non-motorised), as well as providing links to wider path systems within an area. These proposed paths will form a basic framework of paths across the National Park area and embrace Rights of Way, signposted paths, cycle-ways, footways and other routes that provide access to places that the public want to go.

A review of the LLTNP Core Paths Plan (Consultation Draft) maps identifies the following:-

- There are no “draft core paths” or “other paths and routes” proposed for the land area covered by the A82 Pulpit Rock Improvement Scheme location;
- The nearest proposed “draft core paths” are:-
 - North of Pulpit Rock – Core Path (S0334) at **[REDACTED]** (north of Ardlui) connecting to the West Highland Way over the River Falloch; and
 - South of Pulpit Rock – at Sloy Power Station heading south on A82 then west over the West Highland Railway line towards Coiregrogain (S0354 and S0359).
- The nearest proposed “other paths and routes” are:-
 - North of Pulpit Rock (c.1.1km) – at **[REDACTED]** (on west side of A82 heading west over the West Highland Railway line; and

- South of Pulpit Rock (c.1.9km) – at **[REDACTED]** (on west side of the A82 heading south then west over the West Highland Railway and then south over-land towards Sloy Power Station.

5.9.3.2 Cycling

Although the A82 Pulpit Rock Improvements Scheme corridor is currently “cycleable” along its duration, there is no specific provision for cyclists e.g. on-road cycle lanes or adjacent off-road cycle paths. Cyclists therefore have to share the single carriageway with motorised vehicular traffic. The only cycling provision is the “Cyclists Push Button” facility connected to both sets of traffic lights at Pulpit Rock. Along the A82 between Tarbet (where the West Loch Lomond Cycle Path from Balloch ends) and Crianlarich, there is no off-road cycleway or “quieter” on-road cycling alternatives to take cyclists off the A82.

The evolving National Cycle Network (NCN) of on-road and traffic-free cycle routes does not currently include the A82 between Tarbet and Crianlarich – although the LLTNPA have identified Tarbet-Crianlarich as a strategic off-highway route “line” which would fill a critical “gap” in the National Park-wide network of cycle route provision. The nearest section of the NCN is the “Lochs and Glens North” route (which forms part of the NCN No. 7) between Glasgow and Inverness and which passes through the Loch Lomond & the Trossachs National Park on the east side of the National Park between Balloch and Killin. In addition, a Regional Cycle Route (No.40) runs from Balloch to Tarbet. (Source: *the Sustrans website -www.sustrans.org.uk*).

5.9.3.3 Equestrians

There are no riding centres within, or immediately adjacent to, the proposed A82 Pulpit Rock Improvement Scheme location.

There are also no off-road bridleways within, or adjacent to the Pulpit Rock area, whilst the absence of any minor roads surrounding the A82 between Tarbet and Crianlarich negates the opportunity for “safe and quiet” on-road riding alternatives.

5.9.3.4 Community Facilities

At the southern end of the Scheme location there are no community receptors within 1.6km (1 mile) of the traffic signals at Pulpit Rock. The nearest receptors are the **[REDACTED]** House Bed & Breakfast establishment and **[REDACTED]**, a residential property, which are both c.1.9 km south of Pulpit Rock.

At the north-west end of the Scheme location, approximately 100 metres from the north end traffic lights, lies the historic Pulpit Rock. The Rock is located less than 100 metres west of the A82 with limited verge side/“informal layby” parking for around two cars available for use by Pulpit Rock visitors. The nearest signposted formal lay-by provision is located approximately 0.6km north of Pulpit Rock on the east side of the A82 – but with no path link between the lay-by and the Pulpit Rock site.

There is no direct footpath connection to Pulpit Rock from the vehicle verge side parking area. An “informal” pedestrian access route to the Pulpit Rock site is visible from the verge side parking area, heading west over undulating ground - but this route necessitates crossing a low barb-wire topped fence to reach the Pulpit Rock. The “proper” pedestrian access to the site is located approximately 100 metres north of the verge side parking area –

but necessitates walking on the verge of the A82 (along a bend), then along a rough section of track (c. 20 metres in length which links to the A82) before entering the Pulpit Rock site via a pedestrian “kissing-gate”. There are no recorded visitor numbers to the Pulpit Rock site.

Approximately 1.1km north of Pulpit Rock there are two residential properties and a farm ([REDACTED]) which are located on the west side of the A82. Between [REDACTED] and the village of Ardlui (which is located c.2km north of Pulpit Rock) there are a further two residential properties which are also located on the west side of the A82.

Ardlui village has a number of community facilities including:-

- Six residential properties;
- Ardlui Hotel (10 rooms, 2 x bars and 2 x restaurants), self-catering Lodges, Holiday Home Park and Marina (The Ardlui Hotel, Marina and Holiday Home Park is a year round tourism business operation); and
- Ardlui shop (a seasonal operation).

5.9.3.5 Transport Services

Scheduled Bus Services

There are no listed bus stops along the proposed scheme corridor or established unmarked stopping places that scheduled bus services can be “flagged down”. The nearest listed bus stops to the scheme are at Sloy Power Station (c.4.8km south of the site) and Ardlui Hotel (c.2km north of the site).

A summary of the scheduled bus services (October 2008 to May 2009 timetable) using the A82 between Tarbet and Ardlui are summarised in Table 5.9.2 below.

No.	Service	Service Frequency	Bus Operator
914	Glasgow – Fort William	Daily (1 x service per day)	Scottish Citylink
915	Glasgow – Isle of Skye	Daily (1 x service per day)	Scottish Citylink
916	Glasgow – Isle of Skye	Daily (2 x services per day)	Scottish Citylink
914	Fort William - Glasgow	Daily (1 x service per day)	Scottish Citylink
915	Isle of Skye - Glasgow	Daily (1 x service per day)	Scottish Citylink
916	Isle of Skye - Glasgow	Daily (2 x services per day)	Scottish Citylink

Table 5.9.2: Public Bus Services

(Source: Scottish Citylink website – www.citylink.co.uk)

Train Services

The West Highland Railway line runs close to the west of the A82 at Pulpit Rock. The nearest train station to the scheme is at Ardlui. The nearest rail station south of the site is at Arrochar & Tarbet (c.11km south).

A summary of the passenger train services using the West Highland line which stop at Ardlui is summarised in Table 5.9.3. It should be noted that for many of the train services stopping at Ardlui on the Glasgow-Fort William-Mallaig route and the Glasgow-Oban route these are the same trains which physically separate (or join) at Crianlarich. This has been reflected in the “Notes” section of the following table to avoid “double-counting” of scheduled passenger services.

Service	Service Frequency	Operator	Notes
Glasgow – Fort William - Mallaig	Monday – Friday (1 x service per day)	First ScotRail	Request stop at Ardlui (28 Sept to 11 Dec 09 only)
Glasgow – Fort William - Mallaig	Monday – Saturday (1 x service per day)	First ScotRail	Request stop at Ardlui
Glasgow – Fort William-Mallaig	Monday – Saturday (3 x services per day)	First ScotRail	Scheduled stop at Ardlui.
Glasgow – Fort William-Mallaig	Sunday (2 x services reducing to 1 x service – see Notes column for details)	First ScotRail	Scheduled stop at Ardlui. 2 x Sunday services between 17 May and 25 Oct 09 reducing to 1 x Sunday service between 1 Nov and 6 Dec 09
Mallaig-Fort William - Glasgow	Monday – Friday (1 x service per day)	First ScotRail	Request stop only at Ardlui
Mallaig – Fort William- Glasgow	Monday – Saturday (3 x services per day)	First ScotRail	Scheduled stop at Ardlui
Mallaig - Fort William-Glasgow	Sunday (1 x service)	First ScotRail	Request stop only at Ardlui
Fort William - Glasgow	Sunday (2 x services reducing to 1 x service – see Notes column for details)	First ScotRail	Scheduled stop at Ardlui. 2 x Sunday services between 17 May and 25 Oct 09 reducing to 1 x Sunday service between 1 Nov and 6 Dec 09
Glasgow - Oban	Monday – Friday (3 x services per day)	First ScotRail	Same scheduled services as Glasgow-Fort William-Mallaig (<i>see notes above</i>)
Glasgow - Oban	Saturday (1 x service)	First ScotRail	Scheduled stop at Ardlui (23 May to 24 Oct 09 only)
Glasgow - Oban	Sunday (3 x services)	First ScotRail	Scheduled stop at Ardlui (17 May to 27 Sept only) - but in addition to the 2 x Glasgow-Fort William-Mallaig Sunday services (<i>see notes above</i>)
Oban - Glasgow	Monday – Friday (3 x services per day)	First ScotRail	Scheduled stop at Ardlui (22 May to 25 Sept 09 only) – and including the Mallaig-Fort William-Glasgow Monday-Friday services (<i>see above</i>)
Oban - Glasgow	Saturday (3 x services per day)	First ScotRail	Scheduled stop at Ardlui (23 May to 24 Oct 09 only) – and including the Mallaig-Fort William-Glasgow Saturday services (<i>see above</i>)
Oban - Glasgow	Sunday (3 x services)	First ScotRail	Scheduled stop at Ardlui (17 May to 27 Sept 09 only) – and including the Mallaig-Fort William-Glasgow Sunday services (<i>see above</i>)
Highland Caledonian Sleeper (Fort William – London)	Monday – Friday and Sunday (1 x overnight service)	First ScotRail	Request stop only at Ardlui



Service	Service Frequency	Operator	Notes
Highland Caledonian Sleeper (London – Fort William)	Monday – Friday and Sunday (1 x overnight service)	First ScotRail	Request stop only at Ardlui

Table 5.9.3: Train Services

(Source: First ScotRail – Glasgow & the West Highlands Train Times Timetable May to December 2009)

In addition to scheduled passenger train services, there will also be Freight rail traffic using the West Highland Railway line. However this does not form part of the scope of this chapter and therefore has not been assessed.

Ferry Services

Passenger ferry services operate across Loch Lomond from Ardlui (c.2km north of Pulpit Rock) and Inveruglas (c.4.8km south of Pulpit Rock). These are summarised below:-

- Inveruglas to Inversnaid – a foot ferry service across to Inversnaid Hotel which also provides visitor access to attractions within the hotel’s grounds including Rob Roy’s Cave and the West Highland Way long distance walking route. The ferry is a seasonal service operating between March and December; and
- Ardlui to Ardluish – a foot ferry service operated by the Ardlui Hotel providing a link to the West Highland Way. The seasonal service operates between April and October.

In addition, whilst there are commercial pleasure cruiser services operating up and down Loch Lomond eg from Balloch (Sweeney’s Cruises), Tarbet (Cruise Loch Lomond Ltd) and Balmaha (Macfarlane & Son Ltd), there are no Loch Lomond cruiser operators based north of Tarbet.

5.10 Road Drainage and the Water Environment

5.10.1 Introduction

This section addresses the potential effects on the water environment as a result of the proposed scheme. The water environment includes surface waters (e.g. rivers, burns, static water bodies, etc.) and groundwater (e.g. shallow and deep aquifers). In the context of these proposals, there are five water resources features that have been identified within the 250m boundary considered around the proposed Scheme: -

- Loch Lomond;
- Two small surface watercourses;
- One steep rock watercourse; and
- The Groundwater beneath the proposed Scheme.

Apart from general statutory and planning requirements for a development of this nature, the water environment aspects are regulated by two key pieces of legislation, namely; the EU Directive 2000/60/EC (Water Framework Directive) transposed into the Water Environment and Water Services Act (Scotland) 2003 and The Water Environment (Controlled Activities)

(Scotland) Regulations 2005 in respect of discharges to surface or groundwater. This legislation aims to protect and enhance the status of aquatic ecosystems, prevent further deterioration to such ecosystems, promote sustainable use of available water resources, and contribute to the mitigation of floods and droughts.

A full description of the proposed scheme is included in Sections 3 & 4 of this report but the details that have an effect on this assessment are highlighted in the bullet points below.

- The proposed scheme involves the widening / realignment of the existing A82 in the vicinity of Pulpit Rock to enable the removal of the traffic light controlled section of road where there is insufficient road width for safe two way traffic;
- Many of the options involve some form of extension into the Loch and thus will involve moving or modifications to the shoreline of the Loch;
- The proposals involve formalising the road drainage arrangements along the section of road affected by these proposals (i.e. approx. 420m) and a new road drainage outfall draining to the Loch (either directly or indirectly via a local watercourse); and
- Three existing watercourse crossings, which are already in culverts under the A82 (see Figure 5.4), will be incorporated in new or extended culverts / crossings.

In addition, given that only Options level designs are available at this stage, the following assumptions regarding the scope of works have been made to complete the Stage 2 assessment: -

Viaduct Options – In the absence of full design details it has been assumed that the Viaduct and Shortened Option (Viaduct) would both involve discrete pairs of piles (<1m² in area and at around 20m centres) with the lower portion of the Loch Lomond shoreline left reasonably intact and the Loch free to flow under the structure. The Viaduct option would also involve the creation of an embankment section (of approx 60m in length) at the northern end of the Scheme on the Loch side of the carriageway. It has also been assumed that the extensions to the existing culverts under the road will be relatively minor in nature i.e. less than 10m in length each.

Retaining Structure Option – In the absence of full design details it has been assumed that Retaining Structure options involve a sheet pile wall or similar along the alignment shown on the drawings and therefore provide a full barrier along the length of the proposals. It has also been assumed that the extensions to the existing culverts under the road will be relatively minor in nature i.e. less than 10m in length each.

Tunnel Option - In the absence of full design details it has been assumed that the Tunnel option does not involve any construction or permanent works protruding onto the existing shoreline of the Loch. It has also been assumed that the extension to the existing culvert under the road will be relatively minor in nature i.e. less than 10m in length.

5.10.2 Assessment Methodology

The assessment of potential effects on the water environment has been carried out in accordance with the guidance and techniques presented within the “Design Manual for Roads and Bridges”, Volume 11, Section 3, Part 10 “Road Drainage and the Water Environment”.

Water resources features around the development site were identified initially from Ordnance Survey maps, a desktop review of previous reports and other background information, and data collected from site visits. This initial desktop review has been supplemented by consultations with statutory organisations.

Identification of the possible range and magnitude of potential impacts was based on; the guidance within DMRB Volume 11, Section 3, Part 10 “Road Drainage and the Water Environment”, the professional experience of the assessment team, consultation with relevant statutory and non-statutory organisations, previous reports, and liaison with the other members of the environmental assessment team.

The sensitivity of a water resource feature was evaluated using the guidance provided in Tables 5.1 “Water Features: Attributes and Indicators of Quality” & 5.3 “Estimating the Importance of Water Environment Attributes” (DMRB), as well as additional criteria based on the professional experience of the assessment team.

The overall significance of an effect is a product of both the sensitivity of the receptor and the magnitude of the effect. The significance of a potential effect on the water resources features has been evaluated using the guidance provided in Tables 5.5 “Estimating the Significance of Potential Effects” and 5.6 “Definitions of Overall Assessment Scores” (DMRB).

It is noted that some primary mitigation measures have been included in the assessment of impact significance, and these represent what are considered to be standard mitigation measures that would be applied to the construction and operation of such a scheme. The requirement for secondary mitigation measures would need to be fully assessed at Stage 3 when an option has been selected.

It is also valuable to attribute a level of confidence to the predicted impact assessment. In this assessment all impacts have been given at a **medium confidence level** (on a scale of low, medium, and high) except where otherwise stated. This is because the design details are at an options stage, where there is enough information to determine the general form of these proposals (i.e. concept designs) but not any specific design details. In addition, all groundwater data for this assessment has been taken from the desk top work and partial extracts from the draft factual ground investigations report only, as the final ground investigation results were not available at the time of compiling this Stage 2 Draft Report.

In accordance with the methodology set out in the DMRB the following assessments of potential effects have been made for the proposed scheme regardless of which Option is selected: -

Surface Water Quality (Operational Phase) – with regard to the potential contamination from discharge of routine road run off into a watercourse, the DMRB requires that a “Simple Assessment” be made initially to determine whether the watercourse is at high or low risk of pollution. This assessment involves examining the relationship between the predicted volume of run off from the road, the assessed low flow within the watercourse, and the daily flow of vehicles. In this instance the “Simple Assessment” has placed the unnamed watercourses at low risk of pollution, assuming a single direct road drainage discharge to a single watercourse. The design of the road drainage system has not yet been completed, but the above assumptions allow the use of the standard DMRB assessment method to gauge the potential effect. This has then been used as a test to judge the potential impacts on the Loch, and at this stage given that the unnamed watercourses are very small (i.e. with

little dilution) and show no significant effects from the drainage discharge it is concluded that there will also be no significant effects on the Loch.

With regard to the potential contamination of a watercourse from an accidental spillage on the road, the DMRB requires an “Assessment of Pollution Impacts from Accidental Spillages” to be undertaken. This involves consideration of the probability of a spillage accident with an associated risk of a serious pollution risk occurring. It is stated in the Advice Note that watercourses should be protected such that the risk of a serious pollution incident has an annual probability less than 1%. In this instance the pollution risk has been assessed as <<1% and therefore no further consideration is required. This assessment can only be taken as provisional at this stage, as the traffic flows and the road drainage arrangements have not yet been finalised.

Groundwater Quality (Operational Phase) – with regard to the potential contamination of the groundwater from a potential road drainage discharge, the DMRB requires that a risk assessment is carried out based on a scoring matrix. This initial assessment was completed and determined that the groundwater would be at a medium risk of impact if a discharge of road run off was to be made to the ground. This assessment can only be taken as provisional at this stage, as the traffic flows and road drainage arrangements have not yet been finalised, and the ground conditions at the site are based on desktop studies and extracts from the factual ground investigation report only, as final ground investigation results are not yet available.

5.10.3 Baseline Conditions

5.10.3.1 Loch Lomond

The principal surface water resources feature within the study area is Loch Lomond, which is a large loch with a surface area of approximately 70km² and a catchment area of some 770km². The Loch has two distinct morphological areas, with the northern area being long, narrow, and deep, whilst the southern area is broad and shallow. Whilst the catchment contains a number of national ecological designations, the Loch itself does not possess any specific ecological designation. However, it does provide a valuable habitat for breeding birds, invertebrates, and fish, most notably salmon, lamprey and powan. It also supports an otter population, and there is evidence of otter activity in the vicinity of the proposed Scheme. The Loch shoreline in the vicinity of the proposals is very steep, rocky in places, and heavily vegetated with trees and scrub. The Loch is an important source of drinking water for the central belt and is also extensively used as a recreational fishery. The Loch is currently classified by SEPA under the Water Framework Directive with both the northern and southern areas possessing a “Moderate” status with all component parameters (i.e. overall chemistry, overall ecology etc) testing the same for both the north and south areas (based on 2007 data from SEPA Waterbody Data Sheets). The baseline conditions are summarised in Table 5.10.1.

Receptor	Environmental Importance	Socio-Economic Value	Recreational Value	Resilience of Water Body	Overall Sensitivity
Loch Lomond	Water body WFD Status (2007 data) assessed as "Moderate"/ evidence of otters in vicinity of Scheme	Important drinking water supply / significant fishery	Extensive use for pleasure craft / water sports / and fishing	Very large with reasonable ability to buffer discharges, but note current pressures from mixed farming, recreational activities & sewage disposal.	Very High

Table 5.10.1 - Quality of Water Resources: Loch Lomond

5.10.3.2 Two Small Watercourses

There are two small watercourses at the northern end of the proposed scheme, and they both outflow into the Loch via separate culverts under the road (see Figure 5.4). They have been considered together in this assessment as they will both be affected in a similar manner under the proposals. The watercourses are not shown on 1:25,000 scale mapping, and with the steep rock slopes and the railway infrastructure to the west it is difficult to ascertain the size of their catchments. If the catchment areas were in the order of 0.1km², this would give an average daily flow of approximately 526m³/day and a Q95 of approximately 103m³/day. Just upstream of the existing A82 crossing the watercourses were observed as being less than 1m wide with relatively shallow flow and earthen banks. In terms of water quality, the watercourses are not monitored by SEPA and therefore a classification has had to be derived for the purposes of this assessment based on the following; water quality in Loch catchment is generally good and there is no real evidence of significant "List A or List B" aesthetic contaminants. Therefore, the burns have been assigned a WFD status of "Moderate" (i.e. as per the Loch) for the purposes of this assessment. The Burns have not been noted as possessing any significant aquatic ecological features in the ecology section. The baseline conditions are summarised in Table 5.10.2.

Receptor	Environmental Importance	Socio-Economic Value	Recreational Value	Resilience of Water Body	Overall Sensitivity
Unnamed water courses (northern end of the proposed Scheme)	Water body WFD Status assumed "Moderate" - No formal designations. Overall catchment is a Drinking Water Protected Area	Not a fishery or a drinking water supply, but an indirect drinking water supply via the Loch (i.e. overall catchment is a Drinking water Protected Area)	No direct uses but indirectly related to water quality of the Loch and fisheries	Low ability to buffer discharges given small catchment and low flows	Low

Table 5.10.2 - Quality of Water Resources : Small Watercourses

5.10.3.3 Steep Rock Watercourses

There is a small watercourse that flows down the steep rock slope at the southern end of the proposed Scheme (see Figure 5.4), and this passes under the existing road in a culvert. The watercourse is not shown on 1:25,000 scale mapping, and it is difficult to ascertain the size of its catchment. If the catchment area was in the order of 0.1km², this would give an average daily flow of approximately 526m³/day and a Q95 of approximately 103m³/day. The watercourse flows in a very narrow channel which is predominantly on the rock itself. In terms of water quality, the watercourse is not monitored by SEPA and therefore a classification has had to be derived for the purposes of this assessment based on the following; water quality in Loch catchment is generally good and there is no real evidence of significant aesthetic contaminants. Therefore, the watercourse has been assigned a WFD status of “Moderate” (i.e. as per the Loch) for the purposes of this assessment. The watercourse has not been noted as possessing any significant aquatic ecological features in the ecology section.

The baseline conditions are summarised in Table 5.10.3 below.

Receptor	Environmental Importance	Socio-Economic Value	Recreational Value	Resilience of Water Body	Overall Sensitivity
Unnamed water course (southern end of the proposed Scheme)	Water body WFD Status assumed “Moderate” - No formal designations Overall catchment is a Drinking Water Protected Area	Not a fishery or a drinking water supply, but an indirect drinking water supply via the Loch (i.e. overall catchment is a Drinking Water Protected Area)	No direct uses but indirectly related to water quality of the Loch and fisheries	Low ability to buffer discharges given small catchment and low flows	Low

Table 5.10.3. - Quality of Water Resources: Steep Rock Watercourse

5.10.3.4 Groundwater

A desktop geological report (from British Geological Survey) shows that the site is underlain by bedrock which is at or close to the surface across the site and that the superficial deposits are expected to be thin and consist of glacial till. The same report notes that groundwater is likely to occur at a shallow depth within the bedrock near to the Loch, and given the bedrock formation it is expected that it will have negligible inter granular permeability and groundwater movement is therefore dominated by fracture flow. This results in an aquifer of low productivity, but one which is highly vulnerable to contamination from surface activities. Draft Ground Investigation information (April 2009) confirms the presence of shallow groundwater (i.e. less than 5m below ground level) in most locations with the presence of numerous fractures within the bedrock. The SEPA “Bedrock Aquifers” map classifies the bedrock as “fracture flow with low productivity”, which confirms the preliminary geotechnical assessment. The SEPA “Superficial Aquifers” map does not clearly show any drift deposits in this area. The SEPA “Vulnerability of Groundwater in the Uppermost Aquifer” map records the area as “Category 4b – 5” i.e. highly vulnerable. The area is a “Drinking Water Protected Area” and a “Drinking Water (Groundwater)” area, as defined in the SEPA WFD Protected Areas Register.

The baseline conditions are summarised in Table 5.10.4 below.

Receptor	Environmental Importance	Socio-Economic Value	Recreational Value	Resilience of Water Body	Overall Sensitivity
Ground water	Overall catchment is a Drinking Water Protected Area & Drinking Water (ground water) Area. Vulnerability is likely to be "highly vulnerable"	Overall catchment is a Drinking Water Protected Area, with the Loch as a major water supply. Though no known direct groundwater abstractions in immediate vicinity of proposals	Not directly applicable to groundwater (but indirectly related to water quality of the Loch and fisheries)	Overall groundwater body feeding the Loch is relatively large i.e. on a similar scale to the 416km ² catchment of Loch Lomond	Medium

Table 5.10.4. - Quality of Water Resources: Groundwater

It is noted that there is no recorded Scottish Water infrastructure within the study area.

5.11 Disruption During Construction

5.11.1 Introduction

This section of the Stage 2 assessment considers the effects of the scheme associated with disruption due to construction and examines the impacts of the different options under consideration. The assessment considers the potential construction impact on properties close to the scheme and to sensitive environmental receptors. It also looks at any likely significant differences in the magnitude of disruption between route options

5.11.2 Baseline Conditions

The A82 between Glasgow and Fort William is the principal road link to the north west of Scotland. The section of the A82 between Tarbet and Crianlarich is rural in nature and consists of a single 2-lane carriageway. This section includes the long-term (over 20 years) traffic signal provision at Pulpit Rock where vehicular and non-vehicular (cyclist) traffic is controlled by two sets of traffic lights operating on a one way system per phase for a total distance of 190 metres.

This "shuttle working" of traffic creates a bottleneck and can contribute to considerable delays to road users – particularly when a high number of tourists are using the A82 during the summer months and when HGV's and coaches are also using the route.

There are no residential or community facilities in the proximity of the scheme, with the nearest properties at [REDACTED] over 800m to the north.

Pulpit Rock, a Scheduled Monument, lies in close proximity to the north end of the scheme. Loch Lomond itself is also in very close proximity to all scheme options and any construction operations in or close to the water will require close control.

5.11.3 Mitigation

Although construction impacts are transient, they can be significant. Therefore, it is important that nuisance and disturbance are kept to a minimum and that sensitive environmental receptors are protected. Hence it is inevitable that mitigation measures will be required and these will be incorporated into the construction contract documents.

5.11.4 Assessment Methodology

Based on an assessment of the baseline conditions, the assessment of the impact of disruption due to construction has focused on two main areas: disruption to road users and the proximity of options to the key environmental receptors, Pulpit Rock and Loch Lomond. Due to the relatively remote and inaccessible nature of the site, the import and export of materials for each option has also been assessed.

5.12 Viaduct Option

5.12.1 Policy and Plans

5.12.1.1 Option Effects

All of the scheme options are generally supported at all policy levels (national, regional and local). In particular Action I 01 from Argyll and Bute's Local Transport Strategy, which makes specific reference to a tunnel at Pulpit Rock, Policy INF1 – Addressing Infrastructure Constraints and Improvements, Policy TR2 – Improving the Transport Network from the National Park Plan; Policy TRAN 1 – Safeguarding Sites to Improve the Transport Network from the Loch Lomond and Trossachs National Park Consultative Draft Local Plan; TA1 – Transportation Policy from the Dumbarton District Wide Local Plan; and Strategic Issue 6; and REC SI 2 – A82 Trunk Road Improvement, from the Argyll and Bute Structure Plan.

There are no designated developments or land allocations contained in any of the development plans relevant to Pulpit Rock or the immediate surrounding environment. The Scheme is generally supported by the development plans.

The Scheme would conflict with other policies with regards to natural habitats, landscape and cultural heritage features, although mitigation measures would be employed to avoid, reduce or offset any adverse impacts resulting from the implementation of the Scheme.

5.12.1.2 Mitigation

Generally mitigation measures are outlined in the specific environmental topic sections within this report. However, detrimental effects in terms of policy implementation will be reduced or avoided by implementing best practice standards during construction, so that the scheme can contribute more appropriately to policies.

5.12.2 Landscape and Visual Effects

5.12.2.1 Landscape Effects

The Viaduct option is a heavily engineered solution that will give a hard, unnatural edge to the loch. The proposed Viaduct section would create a prominent new feature in the landscape that will be constructed all the way around the existing rock outcrop which already forms a promontory into Loch Lomond. Although the supporting pillars will take the carriageway above the existing loch edge there will be considerable disruption to the bank and the existing vegetation will need to be removed. Although some of the vegetation will grow back, much of the bank will be shaded by the proposed structure which will inhibit vegetation growth. The proposed Viaduct structure has a utilitarian, unsympathetic appearance and will look particularly ugly at low water. There is an awkward juxtaposition between the existing levels and the proposed viaduct structure which will create a gap that will be difficult to maintain. The existing carriageway would need to be broken up and soiled over to avoid a derelict appearance.

The advantage of building a viaduct is that it will not require any rock cutting and removal of vegetation at high level and therefore the area of disruption to the landscape will be smaller than for the shortened options. If this option is to be taken further the design should be developed to create a bold, simple, sculptural structure which would positively contribute to the National Scenic Area, be of the design quality expected in a nationally designated area and complement the large scale landscape and sweeping curves of the road.

5.12.2.2 Visual Effects

The proposed Viaduct option would be a new visually prominent element in the landscape. The largest group of receptors, the road users, would see both the structure on the approaches to it and the cut back of vegetation. Their experience of travelling through the landscape would change. Road users would no longer be required to stop owing to the additional carriageway and removal of traffic lights and therefore the features in the landscape such as Pulpit Rock would become less noticeable. The road would become more uniform with a more engineered edge and would be less distinctive. However, the viaduct section of the Scheme option would sweep travellers out to the edge of the loch and add to the drama of the view over the loch. The scheme will be visible and form a prominent feature from the loch, the West Highland Way and adjacent hills. The views of the Viaduct option will be affected to a lesser extent with greater distance from the scheme. The residential properties within the zone of visual influence which overlook the scheme from medium to long range will notice minor changes to their views. When the viaduct structure has weathered it will become a less prominent feature but will still be visible as a hard, engineered edge to the loch.

5.12.3 Air Quality

A summary of the number of residential properties located within 200m of the all options is provided in Table 5.12.1. *Figure 5.2* illustrates the 200m study area for all the options.

Land Use	Distance Bands				TOTAL
	0-50m	50-100m	100-150m	200-300m	
Residential Properties	0	0	0	0	0

Table 5.12.1: Viaduct Air Quality – Residential property count

The estimated pollution levels at the two selected receptors for the Viaduct option are given in Table 5.12.2 and Figure 5.2 shows the receptor locations.

Receptor	NO ₂ µg/m ³	PM ₁₀ µg/m ³		CO mg/m ³	Benzene µg/m ³	1,3 butadiene µg/m ³
	Annual Mean	Annual Mean	No. days/yr 24hr mean > 50	Annual Mean	Annual Mean	Annual Mean
1: [REDACTED]	3.23	8.92	<1	0.07	0.03	0.02
2: [REDACTED]	3.92	9.09	<1	0.07	0.04	0.03

Table 5.12.2: Viaduct Pollution Levels

There is no change in pollutant concentrations at either of the receptors as the proposed option has no effect on traffic flows, composition or speeds on the A82 beyond the extent of the scheme. The selected receptors are located a significant distance to the north and south of the Scheme and illustrate that local air quality is very good in the vicinity of the Scheme.

The total pollution emissions in 2011 and 2026 for traffic in the regional air quality study area with the Viaduct option in place are provided in Table 5.12.3.

Year	Tonnes/yr				
	CO	THC	NO _x	PM ₁₀	C
2011	0.69 (-0.05)	0.09 (-0.01)	0.55 (+0.05)	0.02 (<0.01)	57.06 (+5.90)
2026 [#]	0.77 (-0.06)	0.10 (-0.01)	0.49 (+0.05)	0.01 (<0.01)	63.64 (+6.49)

Table 5.12.3: Viaduct Total Annual Pollution Emissions

[#] Values calculated using 2026 data but with emissions factors for 2025, as this is the current limit of the DMRB Screening Tool

There is a negligible change in overall pollutant concentrations due to this option. There is a negligible increase in NO_x and carbon emissions due to the small increase in distance travelled due to the Scheme i.e. this option is slightly longer than the existing road. In addition, the increase in average speed along the scheme also results in an increase in emissions of these pollutants. There is a negligible reduction in CO and THC emissions due to the increase in average traffic speed due to the option. For these pollutants the increase in average speed along the scheme results in a decrease in emissions, which outweighs the increase in emissions due to the longer length of road.

Based on the negligible change in total pollution emission and the absence of any relevant sensitive receptors, air quality should not be considered a significant factor for this Viaduct scheme option. A further simple or detailed level assessment is not considered to be required.

5.12.4 Traffic Noise and Vibration

The predicted free-field noise levels at the Pulpit Rock SM with the Viaduct option in place for the 2026 scenario are presented in Table 5.12.4.

Receptor	Traffic Noise Level $L_{A10,18h}$ dB
	2026
1: Pulpit Rock SM	51.7

Table 5.12.4: Tunnel Traffic Noise Levels

The noise levels generated by the road traffic are predicted to decrease by 0.3 dB. This is due to a number of factors. The increase in speed of the road traffic from the baseline to the with scheme situations will increase noise levels, but the increase in speed is sufficient to be above the 75 km/h level at which the road surface correction changes from -1.0 dB to -3.5 dB, which will cause a decrease in noise levels. Additionally, the change in alignment of the road will alter the level of screening provided to the receptor by the terrain. This is a beneficial change of negligible significance, especially considering that a SM is less sensitive to traffic noise changes than residential properties. Noise should not be considered a significant factor for this scheme option.

5.12.5 Land Use

5.12.5.1 Land Use Impacts

As with all options, there would be no permanent severance to properties or fields, although there may be temporary interference during construction with access to land via the sheep creep under the railway line during construction, and to land around Pulpit Rock itself.

The amount of land-take which would be required for the Viaduct option is estimated at around 5350m². Some of this area is woodland (not designated as Ancient Woodland), but is described by the Argyll and Bute Local Biodiversity Action Plan as “Upland Oakwood”, which is characterised by a canopy mainly of oak and birch with holly, rowan and hazel making up the under-storey. The loss of a small amount of this habitat has been assessed as a minor adverse impact.

This option would have the largest impact on the Loch compared to the other options as piles would require to be drilled into the Loch bed. This option would require the most land take of all the options as the route would effectively run parallel to the existing road alignment on the loch side between the road and Loch shore – for a total length of c.400m on a combination of Viaduct and embankment structures. This option would also require more felling of trees than the other options. There would be minimal cutting required as a result of this option compared to the other options.

5.12.5.2 Land Use Mitigation

The amount of land required for the scheme would be kept to a minimum.

Measures will be taken to ensure that access to the area in which Pulpit Rock is situated and the Loch are maintained whenever possible, otherwise alternative access arrangements will be provided.

Where land-take will occur, during both construction and operation, compensation will be required for the landowner, dependent on the type and scale of land use lost.

5.12.6 Archaeology and Cultural Heritage

The Viaduct option would replace the majority of the current road and be set out into Loch Lomond except the short length of embankment section at the northern end of the Scheme. The portion of the new road that would be supported by the viaduct would join with current road line where it passes in front of the Pulpit Rock. At this point a loch side embankment section would support the carriageway. Whilst the new Viaduct would introduce a modern structure carrying the new road on a slightly different alignment into the foreground of Pulpit Rock, this would not represent a significant change to the baseline.

It is, therefore, considered that this option would not cause a significant change to the setting of Pulpit Rock.

This option would not have a direct effect on the Tarbet to Crianlarich Military Road.

5.12.7 Ecology and Nature Conservation

Effects common to all options:

Depending on the timing of the proposed works, there may be potential impacts upon breeding birds using the woodland and scrub habitats. Potential impacts include direct and permanent removal of nests, nesting habitats or foraging habitats and temporary disturbance associated with construction to breeding birds due to noise, vehicle / machinery movement and pollution (Schedule 1 birds carry with them important international legal implications).

Water quality along the Loch shoreline and the small burn flowing to the north of the traffic light may be compromised due to construction and operation impacts. The encroachment into the littoral habitats of the loch shore will have potential impacts upon fish species through pollution, and direct removal of suitable silt / sand habitats for lamprey larvae and gravel spawning locations for powan and locations utilised by Atlantic salmon.

Effects common to the viaduct option only:

The Viaduct option would carry the carriageway on a c.300 metres section of viaduct built out into the waters edge of Loch Lomond and linking to a short section of embankment on the loch shore side of the existing A82 - which may require some slope cutting in its construction. There will also be a requirement for an embankment on the east side of the road. No significant or direct impacts would be expected upon Pollochro Woods SSSI or Ben Vorlich SSSI and there would be no encroachment upon either of the ancient woodland sites identified within the wider area.

Due to the permanent Loch substratum land take associated with this option, habitats that are likely to be directly and permanently lost include scattered trees (mainly birch but also oak and alder) on the shoreline, scrub and understory assemblages. The shoreline and littoral substratum of the Loch will be lost where the submerged structure encroaches out into the Loch. These permanent habitat losses increase the potential for severance and fragmentation of these habitats, and lower the capacity for natural regeneration of these habitat assemblages after the completion of works within the wider shoreline context.

Appropriate mitigation measures will have to be adopted where the stands of Japanese knotweed are implicated – full eradication will be required prior to works commencing (see Figure 5.1 for locations).

This option will affect an area of trees with potential for roosting bats. There are mature oak trees on either side of the road between the two sets of traffic lights and areas of mixed broadleaved woodland with mature trees to the north of the traffic lights. Permanent loss of these trees due to construction would reduce the overall capacity of the area to harbour bats, alongside temporary indirect disturbance to roosting bats in the wider area due to construction noise. Further checks for bat roosts and activity are necessary to determine whether there is potential for bats within these trees.

Otters will be directly impacted during construction and operation. The location of the otter shelter beneath the southern traffic lights renders its loss unavoidable. Licensing procedures must be adhered to with regard to removal of the otter shelter. There will be an abrupt change at the point where the semi-natural shoreline meets the engineered structure built out onto the Loch leading to the road. Otters will have to enter the water and swim to reach the continuation of semi-natural shoreline at the other end of the structure. It is possible that they may choose to climb the structure and transit the road at this point rather than swim. The risk of this occurring must be appropriately mitigated to ensure otter road casualties are not a result of this scheme. There will be temporary disturbance to otters during the construction period - impacts such as night lighting, noise, pollution incidents and injury via vehicles / machinery being relevant considerations. Otter activity along this stretch of the Loch is known to be frequent, and may be adversely affected by the construction of an artificial structure which will effectively fragment this otherwise semi-natural shoreline. Otter activity will be monitored closely for the duration of the assessment period.

5.12.8 Pedestrians, Cyclists, Equestrians and Community

5.12.8.1 Construction Effects

General effects for all options include:

- Temporary (Significant/Adverse) extended local journey times (for residents, tourists, leisure and business traffic) who currently use the A82 to access community, business, tourism and recreation receptors/locations between Tarbet and Crianlarich. The works would entail full closure of the A82 at Pulpit Rock for a period during the scheme construction phase with traffic diverted between Tarbet and Crianlarich;
- Permanent loss (Significant/Adverse) of the existing small "informal layby"/verge side parking area available for use by Pulpit Rock historic site visitors - due to the proposed works; and
- Temporary severance (Significant/Adverse) of pedestrian, cycle, and equestrian user access along the section of the A82 at Pulpit Rock during construction period.

The potential construction effects of the Viaduct option can be summarised as:-

- Temporary disruption (Minor Adverse) to leisure craft navigating Loch Lomond (in proximity to the west shore at Pulpit Rock) during construction of the Viaduct section of the Scheme which would extend into the Loch. Temporary mitigation might require a limited "exclusion zone" for leisure craft around the Loch based construction works – following discussion and agreement with the LLTNPA; and

- This option should have no construction impact on the West Highland railway line and therefore no temporary disruption to rail journey travel times.

5.12.8.2 Operational Effects

The potential operational effects of the Viaduct option include:-

- The proposed 2 metre footway on the east side of the c.300 metre length of the Viaduct section of this Scheme option would also be suitable for cyclist use – but is unlikely to be suitable for equestrians (eg insufficient path width and barrier/parapet height). The raised footway (same hard surface as the Viaduct carriageway) would provide increased safety for cyclists (as well as pedestrians) at Pulpit Rock and would satisfy the Sustrans cycling consultation response statement that 2 metre provision would provide “sufficient physical sanctuary from road traffic”. It would also satisfy the Sustrans consultation response recommendation that the width of the raised surfaced verge outwith the solid white road edge markings of the trunk road carriageway should be maximised to achieve 2m unrestricted bitmac of the same surface as the new road itself (free of drainage chamber heads, infill and other hazards). However, the provision of a raised footway would only be for c.75% of the overall length of the Viaduct option (the 0.6m verge along the Embankment section would be too narrow for a footway/cycle provision) and it would not fulfil Sustrans recommendation of provision on both the east and west sides of the new Pulpit Rock carriageway alignment. This would result in north bound cyclist/pedestrian users having to traverse the A82 to access/exit the section of footway creating safety issues in relation to the passing vehicular traffic; and
- A safer journey route for locals, visitors (day, staying and transient) and local business vehicular traffic at Pulpit Rock – with the removal of potential for traffic “back-up” as the Pulpit Rock traffic lights become obsolete and unimpeded vehicle movements are provided along the new scheme.

5.12.8.3 Mitigation

During operation, replacement of the small “informal layby”/verge side parking area available for use by Pulpit Rock visitors to an alternative location within proximity to the historic site would maintain provision and would mitigate the permanent loss of the baseline parking availability. There is currently no such alternative provision provided in the Viaduct design option and the recommended mitigation would be for further discussions to be held to resolve the issue of replacement provision to avoid the adverse impact of permanent loss of visitor parking amenity.

5.12.9 Water Drainage and Quality

5.12.9.1 Construction Effects

The construction impacts of the Viaduct option are summarised in Table 5.12.5 below.

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Surface Water Quality	Sediment mobilisation and spillage or discharge of other pollutants in water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to area of Loch around the works, temporary)	Neutral for the unnamed watercourses & Moderate Adverse for the Loch
Flooding	Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land at the burns)	Negligible Adverse (localised to the burns, temporary)	Neutral for the surrounding land
Geomorphology and Hydrology	Alteration of water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised 400m along the shore, temporary) for the Loch Minor Adverse (highly localised, temporary) for Unnamed Watercourses	Moderate Adverse for the Loch & Neutral for the unnamed watercourses
Groundwater	Potential disturbance of groundwater movement	Groundwater beneath the site (Medium)	Negligible Adverse (localised to discrete points along 400m of shoreline, temporary)	Neutral for the groundwater
	Potential contamination of groundwater	Groundwater beneath the site (Medium)	Minor Adverse (localised, temporary)	Slight Adverse for the groundwater

Table 5.12.6: Construction Impacts on water resources (Viaduct option)

5.12.9.2 Operational Effects

The operational impacts of the Viaduct option are summarised in Table 5.12.7 below.

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Surface Water Quality	Discharge of road run-off to water courses/Loch	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (localised to area of dispersion, permanent)	Neutral for the unnamed watercourses & Neutral for the Loch
	Other Road and Infrastructure maintenance	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (localised, permanent)	Neutral for the unnamed watercourses & Neutral for the Loch
Flooding	Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land at the burns)	Negligible Adverse (highly localised, permanent)	Neutral for the surrounding land

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Geomorphology and Hydrology	Alteration of water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to discrete points along 300m of shore & 60m of embankment, permanent) for the Loch Minor Adverse (localised, permanent) for Unnamed Watercourses	Moderate Adverse for the Loch & Neutral for the unnamed watercourses
	Alteration to land drainage patterns	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse for both the Loch and the unnamed watercourses (localised, permanent).	Neutral for both the Loch and the unnamed watercourses
	Run-off from the scheme into watercourses	Unnamed Watercourses (Low)	Negligible Adverse for the unnamed watercourses (localised, permanent)	Neutral for the unnamed watercourses
Groundwater	Potential disturbance of groundwater movement	Groundwater beneath the site (Medium)	Negligible Adverse (highly local to discrete points at piles, permanent)	Neutral for the groundwater
	Potential contamination of groundwater	Groundwater beneath the site (Medium)	Moderate Adverse (localised, permanent)	Moderate Adverse for the groundwater

Table 5.12.7: Operational Impacts on water resources (Viaduct option)

Note:- *The assessment above should be read in conjunction with the following notes - which are also applicable to the Road Drainage and the Water Environment impact assessment of the other Scheme Design options detailed in sections 15.13.9; 15.14.9 and 15.15.9 of this report:-*

- The assessments above are based on the options level design information (i.e. not detailed scheme design) and are meant to enable differences between the options to be highlighted rather than a definitive assessment of significant potential effects;
- Only desktop and draft factual Ground Investigation data was available for this assessment, and therefore the assessment of potential groundwater impacts can only be given a medium confidence value; and
- The design of the surface water drainage arrangements is not yet at a high level of detail and therefore the assessment of related impacts can only be given a medium confidence value.

5.12.9.3 Mitigation

Primary mitigation measures have been assumed to be included in the above assessments, and these measures represent what are considered to be standard mitigation measures that would be applied to the design, construction, and operation of such a scheme. These would include standard conditions that would usually be required by statutory authorities or measures that a designer or contractor would be expected to take based on current best practice. A summary of some of the key primary mitigation measures assumed are noted below: -

- The development and implementation of a detailed site management plan based on the best practice guidance detailed in Pollution Prevention Guidelines published by SEPA and CIRIA Report C532 & C648, as a minimum. In particular, the control of sediment disturbance on the bed of the loch and the control of concrete use in or over the loch should be covered in detail;

- The Contractor should have detailed method statements for working within the loch or a watercourse, and these should cover setting out a minimum working area to limit disturbance and surveying and recording the baseline conditions in advance of the works for reinstatement purposes;
- New surface water drainage infrastructure should be designed in accordance with Sustainable Urban Drainage System principles e.g. measures to attenuate and provide treatment of the surface water run off before discharge. The extent of these provisions and the discharge point should be derived based on the advice within the EIA in Stage 3;
- New road drainage outfalls and extensions to culverts should be designed in accordance with best practice to reduce loss of natural bed / bank and prevent erosion. Discharges from new road drainage outfalls should be limited to an appropriate rate for each watercourse; and
- In addition, it is recommended that a detailed method statement be prepared for the tunnelling operation, and this should cover the storage, containment, treatment, etc. of the drilling fluids used.

5.12.10 Disruption during Construction

Traffic delays created by the Viaduct option construction will be associated with the realignment of the existing road. In general, traffic will be controlled by an extension of the one-way system already in place over this section of the A82. It is expected that traffic lights and a one-way working system will be installed for the full length of the site, a total length of some 400 metres. The existing road will form the main route for through traffic while the offline parts of the new alignment are being constructed. A mandatory 30mph speed limit restriction is expected over the whole length of the works.

Full closures of approximately 10 weeks will be required for tie-in of the new viaduct to the existing road. During full closures, traffic will be diverted from Crianlarich through the A85-A819-A83 route via Inveraray to Tarbet.

A likely construction period of 54 weeks for the Viaduct option construction is expected with temporary traffic management measures in place for the full period.

The Viaduct Option has the greatest intrusion into the Loch and it is proposed that the main viaduct construction will be carried out from floating platforms on the loch to minimise disruption to road users. Careful control measures and site management will be required and this issue is discussed in more detail in sections 5.12.7 and 9. The Viaduct Option also requires some construction works along the line of the existing road adjacent to Pulpit Rock.

The principal source of material to be disposed off site will arise from the viaduct sub-structure construction and this is estimated to be in the region of 6,000 cubic metres. In addition, a small volume of earthworks material will require to be imported. Delivery of materials to the site will be a matter for the construction contractor, however it is anticipated that the loch could be used for material haulage. In particular, using the loch will be of benefit for the transport of bridge deck beams which may be difficult to deliver by road.

5.13 Tunnel Option

5.13.1 Policy and Plans

See section 5.12.1.

5.13.2 Landscape and Visual Effects

5.13.2.1 Landscape Effects

The Tunnel option will not encroach into Loch Lomond and therefore will be less intrusive than the other options. Although some vegetation will need to be removed to accommodate the blasting and portals, less vegetation will be removed from the loch side and from the rock face than for the other options. This option would also offer less intrusion to the wider landscape than the other options. The advantages of the Tunnel are that it offers relatively minor disruption to the existing landscape and would add to the drama of the landscape experience. The disadvantages are that the horizontal alignment of the road would be evened out and there would be a risk of light pollution in the rural landscape because the Tunnel would need to be lit. The setting of Pulpit Rock would be changed because the entrance to the Tunnel at the north end would be nearer to the Rock.

5.13.2.2 Visual Effects

The view from the road would be dramatically altered with an exciting new feature which would alter the receptor's perception of the landscape. Travellers' perception of Pulpit Rock would be also be changed. For northbound travellers the existing road swings round the main rock outcrop to face Pulpit Rock. The proposed Tunnel would reveal Pulpit Rock suddenly to the side when leaving the Tunnel. The views from Loch Lomond and the West Highland Way and adjacent hills will be hardly changed owing to their distance from the scheme and the minimal disruption to the landscape that the works would create. The residential properties will barely notice changes to their views.

5.13.3 Air Quality

Pollutant levels for at local sensitive receptors for this scheme option are the same as those given in 5.12.3.

The total pollution emissions in 2011 and 2026 for traffic in the regional air quality study area with the Tunnel option in place are provided in Table 5.13.4

Year	Tonnes/yr				
	CO	THC	NO _x	PM ₁₀	C
2011	0.61 (-0.12)	0.08 (-0.02)	0.51 (+0.01)	0.01 (<0.01)	53.60 (+2.45)
2026 [#]	0.69 (-0.15)	0.09 (-0.02)	0.45 (+0.01)	0.01 (<0.01)	59.39 (+2.24)

Table 5.13.4: Tunnel Total Annual Pollution Emissions

[#] Values calculated using 2026 data but with emissions factors for 2025, as this is the current limit of the DMRB Screening Tool

Based on the negligible change in total pollution emission and the absence of any relevant sensitive receptors, air quality should not be considered a significant factor for this scheme option. A further simple or detailed level assessment is not considered to be required.

5.13.4 Traffic Noise and Vibration

The predicted free-field noise levels at the Pulpit Rock SM with the Tunnel option in place for the 2026 scenario are presented in Table 5.13.5.

Receptor	Traffic Noise Level $L_{A10,18h}$ dB
	2026
1: Pulpit Rock SM	50.8

Table 5.13.5: Tunnel Traffic Noise Levels

The noise levels generated by the road traffic are predicted to decrease by 1.2 dB. This is due to a number of factors. The increase in speed of the road traffic from the baseline to the with scheme situations will increase noise levels, but the increase in speed is sufficient to be above the 75 km/h level at which the road surface correction changes from -1.0 dB to -3.5 dB, which will cause a decrease in noise levels. Additionally, the change in alignment of the road will alter the level of screening provided to the receptor by the terrain. This is a beneficial change of minor significance, especially considering that a SM is less sensitive to traffic noise changes than residential properties. Noise should not be considered a significant factor for this scheme option.

5.13.5 Land Use

5.13.5.1 Land Use Impact

There would be no permanent severance to properties or fields, although there may be temporary interference during construction with access to land via the sheep creep under the railway line during construction, and to land around Pulpit Rock itself.

The amount of land-take which would be required for the Tunnel option is estimated at around 4780m². Some of this area is woodland (not designated as Ancient Woodland), but is described by the Argyll and Bute Local Biodiversity Action Plan as “Upland Oakwood”, which is characterised by a canopy mainly of oak and birch with holly, rowan and hazel making up the under-storey. The loss of a small amount of this habitat has been assessed as a minor adverse impact.

This option would require the least amount of land take, as land would only be altered around the tunnel portals, although there would be a loss of a small amount of woodland. There would be no changes to the land (woodland) above the tunnel. There would be no direct impact on the Loch.

5.13.5.2 Land Use Mitigation

See section 5.12.5.2.

5.13.6 Archaeology and Cultural Heritage

The Tunnel entrance would be visible to the southeast of Pulpit Rock and the line of the proposed new road as it passes in front of the Rock would change because of the of the Tunnel. The traditional route of the road sweeping in from the southeast would be replaced by a more direct route as the proposed road emerged from the Tunnel. The line of the proposed road would be closer to the Rock but it would not encroach upon the enclosed

grazing land area where the Rock is located. The entrance to the Tunnel would lie to the south of the open aspect from Pulpit Rock to the north and north-east that Historic Scotland highlight in their letter of 22 March 2007.

It is, therefore, considered that this option would not cause a significant change to the setting of Pulpit Rock.

This option would not have a direct effect on the Tarbet to Crianlarich Military Road.

If surface works are required along the route of the Tunnel there is the potential for disturbance to the flat area at the summit of the Rock which has been identified as of moderate archaeological potential.

5.13.7 Ecology and Nature Conservation

For effects common to all options see section 5.12.7.

The Tunnel option would involve the construction of a tunnel straight through the rock face of the promontory to the west of the existing road. It would maintain the line of the carriageway, bypassing the existing curve with no requirement to widen verges through land take or building out onto the Loch. It will require the demolition of a section of hillside for entrance and exit points of approximately 8m x 14m, with up to 40 metres of road verge habitat affected either side of the tunnel.

From an ecological perspective this option has the least impact, requiring the least amount of permanent land take and no encroachment out onto the Loch. Habitats that are likely to be directly and permanently lost include the area of cliff and hillside where the entrance and exit points of the tunnel will be located together with scattered trees (mainly birch but also oak and alder) and scrub from the hillside and existing road verges leading up to the tunnel. The northern section of the hillside where the road will cut through harbours an understory community rich in some scarce bryophytes such as the filmy ferns, *Hymenophyllum tunbrigense* and *H.wilsonii* and the liverworts *Herbertus aduncus*, *Douinia ovata* and *Bazzania tricranata*. To the south, an area rich in the scarce moss *Dicranum scottianum* and liverwort *Harpanthus scutatus* would also be directly and permanently lost. Permanent loss of these species assemblages increases the potential for fragmentation of populations, and lowers the capacity for natural regeneration after the completion of works within the wider shoreline context.

Appropriate mitigation measures will have to be adopted where the stands of Japanese knotweed are located – full eradication will be required prior to works.

This option will affect fewer trees with potential for roosting bats compared with the other options. Areas with bat roost potential which would be affected are confined to the four large mature oaks to the west of the southern traffic lights which would have to be demolished to provide an entrance to the tunnel. Permanent loss of these trees due to construction would reduce the overall capacity of the area to harbour bats, alongside temporary indirect disturbance to roosting bats in the wider area due to construction noise (which would possibly be prolonged in the case of this option). Further checks for bat roosts and activity are necessary to determine whether there is potential for bats within these trees.

The impacts upon bat species during operation of the scheme will depend, in part, on the extent to which the tunnel needs to be lit for safety reasons. A further assessment of the

impact of lighting on bat feeding behaviour (and bird feeding behaviour) will be required if this option is progressed further.

Otters may be indirectly impacted during construction of this option however there would be no requirement for the demolition of the otter shelter beneath the southern set of traffic lights. The Loch shoreline will not have to be modified to accommodate the tunnel, so otter foraging activity will not be adversely affected. There will be temporary disturbance to otters during the construction period - impacts such as night lighting, noise, pollution incidents and injury via vehicles / machinery being relevant considerations. Otter activity along this stretch of the Loch is known to be frequent, and will be monitored closely for the duration of the assessment period.

5.13.8 Pedestrians, Cyclists, Equestrians and Community

5.13.8.1 Construction Effects

For general effects applicable to all options see section 5.12.8.1.

Potential construction impacts specific to the Tunnel design option are anticipated to be:-

- Temporary disruption (Slightly Adverse) to scheduled West Highland Railway passenger and freight rail journeys caused by engineering works which may be required for the proposed retaining wall/slope strengthening under the current railway at the southern portal entrance to the proposed Pulpit Rock tunnel. These possible effects could be mitigated by the implementation of agreed line possessions e.g. overnight, week-ends etc to allow the works to be safely accommodated and to reduce the effects on the overall First ScotRail scheduled timetable; and
- The Tunnel option would have no construction impact on leisure craft navigating Loch Lomond (in proximity to the west shore at Pulpit Rock).

Full details of the road user disruption during the construction period are provided in section 5.13.10.

5.13.8.2 Operational Effects

The potential operational effects of the Tunnel option include:-

- The proposed 1 metre hard cycle strips on either side of the carriageway through the tunnel (but with no barrier separation from vehicular traffic) would not provide increased safety for cyclists and fails to meet Sustrans recommendation that the width of the surfaced verge retained outwith the solid white road edge markings of the trunk road carriageway for cycling should be maximised to achieve 2m unrestricted bitmac of the same surface as the new road itself (free of drainage chamber heads, infill and other hazards, on both east and west sides of the new carriageways). Indeed the Sustrans consultation response states that if cycle verge provision is reduced to be narrower than 2 metres, "the edge route would not offer sufficient physical sanctuary from road traffic"; and
- A safer journey route for locals, visitors (day, staying and transient) and local business vehicular traffic at Pulpit Rock – with the removal of potential for traffic

“back-up” as the Pulpit Rock traffic lights become obsolete and unimpeded vehicle movements are provided through the new tunnel alignment.

5.13.8.3 Mitigation

See section 5.12.8.3

5.13.9 Road Drainage and the Water Environment

5.13.9.1 Construction Effects

The construction impacts of the Tunnel Option are summarised in Table 5.13.6.

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Surface Water Quality	Sediment mobilisation and spillage or discharge of other pollutants in water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to end of Tunnel and working areas, temporary)	Neutral for the unnamed watercourses & Moderate Adverse for the Loch
Flooding	Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land at the burns)	Negligible Adverse (localised around the burns, temporary)	Neutral for the surrounding land
Geomorphology and Hydrology	Alteration of water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (highly localised, temporary) for the Loch. Minor Adverse (highly localised, temporary) for Unnamed Watercourses	Neutral for the Loch & Neutral for the unnamed watercourses
Groundwater	Potential disturbance of groundwater movement	Groundwater beneath the site (Medium)	Minor Adverse (localised to length of tunnel, temporary)	Slight Adverse for the groundwater
	Potential contamination of groundwater	Groundwater beneath the site (Medium)	Minor Adverse (localised, temporary)	Slight Adverse for the groundwater

Table 5.13.6: Construction Impacts on water resources (Tunnel option)

5.13.9.2 Operational Effects

The operational impacts of the Tunnel Option are summarised in Table 5.13.7. below.

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Surface Water Quality	Discharge of road run-off to water courses/Loch	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (localised to area of dispersion, permanent)	Neutral for the unnamed watercourses & Neutral for the Loch
	Other Road and Infrastructure maintenance	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (localised, permanent)	Neutral for the unnamed watercourses & Neutral for the Loch
Flooding	Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land at the burns)	No Effects	No Effects

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Geomorphology and Hydrology	Alteration of water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (highly localised, permanent) for the Loch Minor Adverse (highly localised, permanent) for Unnamed Watercourses	Neutral for the Loch & Neutral Adverse for the unnamed watercourses
	Alteration to land drainage patterns	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse for both the Loch and the unnamed watercourses (localised, permanent)	Neutral for both the Loch and the unnamed watercourses
	Run-off from the scheme into watercourses	Unnamed Watercourses (Low)	Negligible Adverse for the unnamed watercourses (localised, permanent)	Neutral for the unnamed watercourses
Groundwater	Potential disturbance of groundwater movement	Groundwater beneath the site (Medium)	Moderate Adverse (over the length of the Tunnel, permanent)	Moderate Adverse for the groundwater
	Potential contamination of groundwater	Groundwater beneath the site (Medium)	Moderate Adverse (localised, permanent)	Moderate Adverse for the groundwater

Table 5.13.7: Operational Impacts on water resources (Tunnel option)

Note: see Assessment Note under section 15.12.9.2.

For primary mitigation measures see 5.12.9.3

5.13.10 Disruption During Construction

Traffic delays created by the tunnel construction will be associated with the tie-in of the tunnel/new road to the existing road. In general, traffic will be controlled by an extension of the one-way system already in place over this section of the A82. It is expected that traffic lights and a one-way working system will be installed for the full length of the site, a total length of some 400 metres. The existing road will form the main route for through traffic while the tunnel and approaches are being constructed. A mandatory 30mph speed limit restriction is expected over the whole length of the works.

Full closures of approximately 22 weeks will be required under this option, principally due to the works required at the approach to the south portal. During full closures, traffic will be diverted from Crianlarich through the A85-A819-A83 route via Inveraray to Tarbet.

A likely construction period of 64 weeks for the Tunnel option construction is expected with temporary traffic management measures in place for the full period.

The Tunnel Option does not intrude into the Loch, however construction works for the north portal and approach will be in proximity to Pulpit Rock.

Substantial quantities of material to be disposed off site will arise from the tunnel construction. Delivery of materials to and from the site will be a matter for the construction contractor, however, under this option it is more likely that the contractor will use road haulage rather than water.

5.14 Shortened Option (Viaduct)

5.14.1 Policy and Plans

See section 5.12.1.

5.14.2 Landscape and Visual Effects

5.14.2.1 Landscape Effects

The Shortened Option (Viaduct) would involve the introduction of a viaduct encroaching into the loch, a steep (80 degrees) and high (8.9m) cutting and an area of fill in the vicinity of Pulpit Rock. The proposed Shortened Viaduct is a heavily engineered solution that will give a hard, unnatural edge to the loch. It would create a prominent new feature in the landscape but it would be less intrusive than the Viaduct option (see section 5.12.2) because it doesn't go all the way round the rock outcrop and therefore its position is less prominent. However the proposed rock cutting together with the Shortened Viaduct would create a large man made, engineered element in the landscape. A considerable amount of vegetation will be removed on the banks of the Loch Lomond to accommodate the proposed viaduct and from the area of the rock cutting. If this option is to be taken further the design should be developed to create a bold, simple, sculptural structure for the viaduct which would positively contribute to the National Scenic Area; be of the design quality expected in a nationally designated area; and complement the large scale landscape and sweeping curves of the road.

Although the supporting pillars of the viaduct will take the carriageway above the existing edge there will be considerable disruption to the bank. Although some of the vegetation will grow back, much of the bank will be shaded by the proposed structure which will inhibit vegetation growth. The proposed cutting will also result in a large scar on the hillside which will not be suitable for vegetation growth. Care will need to be taken in the choice of facing materials. The proposed Shortened Viaduct structure has a utilitarian, unsympathetic appearance and will look particularly ugly at low water. The proposed area of fill will be slightly closer to Pulpit Rock than the existing carriageway.

5.14.2.2 Visual Effects

The proposed Shortened Viaduct and rock cutting would introduce a new prominent element in the landscape which would be visible from a wide area. The road users would notice the Shortened Viaduct structure on approach, the widened road, the high cutting and the cut back of vegetation. Their experience of travelling through the landscape would change. They would travel faster owing to the additional carriageway and removal of traffic lights and the features in the landscape such as Pulpit Rock would become less noticeable. The road would become straighter with a more engineered edge and less distinctive. The Shortened Viaduct would take travellers to the loch edge and improve the views of Loch Lomond but the cutting would introduce a hard, unnatural adjacent feature.

This option will be visible from the loch, the West Highland Way and adjacent hills although the degree of intrusion into the view will reduce with distance from the scheme. The residential properties will notice some changes to their views depending on the extent of screening by vegetation and distance from the scheme. When the Shortened Viaduct

structure and rock cut have weathered they will become less prominent features but will still be visible from a wide area as hard, engineered elements.

5.14.3 Air Quality

Pollutant levels for at local sensitive receptors for this scheme option are the same as those given in 5.12.3.

The total pollution emissions in 2011 and 2026 for traffic in the regional air quality study area with the Shortened Option (Viaduct) in place are provided in Table 5.14.4.

Year	Tonnes/yr				
	CO	THC	NO _x	PM ₁₀	C
2011	0.66 (-0.08)	0.09 (-0.01)	0.52 (+0.03)	0.01 (<0.01)	54.51 (+3.36)
2026 [#]	0.74 (-0.10)	0.10 (-0.02)	0.46 (+0.03)	0.01 (<0.01)	60.80 (+3.65)

Table 5.14.4: Shortened Viaduct Total Annual Pollution Emissions

[#] Values calculated using 2026 data but with emissions factors for 2025, as this is the current limit of the DMRB Screening Tool

Based on the negligible change in total pollution emission and the absence of any relevant sensitive receptors, air quality should not be considered a significant factor for this scheme option. A further simple or detailed level assessment is not considered to be required.

5.14.4 Traffic Noise and Vibration

The predicted free-field noise levels at the Pulpit Rock SM with the Shortened Option (Viaduct) in place for the 2026 scenario are presented in Table 5.14.5.

Receptor	Traffic Noise Level L _{A10,18h} dB
	2026
1: Pulpit Rock SM	51.3

Table 5.14.5: Tunnel Traffic Noise Levels

The noise levels generated by the road traffic are predicted to decrease by 0.7 dB. This is due to a number of factors. The increase in speed of the road traffic from the baseline to the with scheme situations will increase noise levels, but the increase in speed is sufficient to be above the 75 km/h level at which the road surface correction changes from -1.0 dB to -3.5 dB, which will cause a decrease in noise levels. Additionally, the change in alignment of the road will alter the level of screening provided to the receptor by the terrain. This is a beneficial change of negligible significance, especially considering that a SM is less sensitive to traffic noise changes than residential properties. Noise should not be considered a significant factor for this scheme option.

5.14.5 Land Use

5.14.5.1 Land Use Impact

There would be no permanent severance to properties or fields, although there may be temporary interference during construction with access to land via the sheep creep under the railway line during construction, and to land around Pulpit Rock itself.

The amount of land-take which would be required for the Shortened Option (Viaduct) is estimated at around 5040m². Some of this is woodland (not designated as Ancient Woodland), but is described by the Argyll and Bute Local Biodiversity Action Plan as “Upland Oakwood”, which is characterised by a canopy mainly of oak and birch with holly, rowan and hazel making up the under-storey. The loss of a small amount of this habitat has been assessed as a minor adverse impact.

This option would involve the second lowest amount of land take of all the options as the northern extent of the option would effectively involve the widening of the current road alignment. This option would involve a small amount of cutting and filling. There would be a direct impact on the Loch as a result of inserting the piles required to support the viaduct into the bed of the Loch.

5.14.5.2 Land Use Mitigation

See section 5.12.5.2

5.14.6 Archaeology and Cultural Heritage

The line of the proposed new Shortened Viaduct route option as it passes in front of Pulpit Rock would follow broadly the same alignment as the current A82, and although more extensive embankments would be visible from the Rock, they would not encroach upon the enclosed land area in which the Rock is located. To the immediate southeast of the Rock there would be some cutting back into the rock face of the promontory, but this would not significantly open up the enclosed landscape around the Rock. The Shortened Viaduct structure would not be visible from the Rock.

It is, therefore, considered that this option would not cause a significant change to the setting of Pulpit Rock.

This option would not have a direct effect on the Tarbet to Crianlarich Military Road.

5.14.7 Ecology and Nature Conservation

For effects common to all options see section 5.12.7.

This option will involve cutting into the slope of the rock face set at an 80 degree angle and will result in a cutting of approximately 8.9 metres in height. The option includes a proposed viaduct (rather than a retaining structure) for the carriageway which is built out partly into the waters edge of the loch and is approximately 175 metres in length and the improvements to the existing road will extend a further 185 metres.

No significant or direct impacts would be expected upon Pollochro Woods SSSI or Ben Vorlich SSSI. There will not be encroachment upon either of the ancient woodland sites identified within the wider area.

There is permanent terrestrial and Loch substratum land take associated with this option and the habitats that are likely to be directly and permanently lost include a substantial area of cliff from the hill to the west of the road, scattered trees (mainly birch but also oak and alder) on both the cleared cliff and the shoreline, scrub and understorey assemblages including the uncommon moss, *Dicranum scottianum* and liverwort, *Harpanthus scutatus*. The shoreline and littoral substratum of the Loch will be lost where the submerged structure encroaches

out into the Loch. These permanent habitat losses increase the potential for severance and fragmentation, and lower the capacity for natural regeneration after the completion of works within the wider shoreline context.

Appropriate mitigation measures will have to be adopted where the stands of Japanese knotweed are located – full eradication will be required prior to works.

This option will affect two areas of trees with potential for roosting bats. There are mature oak trees on either side of the road between the traffic lights, and areas of mixed broadleaved woodland with mature trees to the north of the traffic lights. Permanent loss of these trees due to construction would reduce the overall capacity of the area to harbour bats, alongside temporary indirect disturbance to roosting bats in the wider area due to construction noise. Further checks for bat roosts and activity are necessary to determine whether there is potential for bats within these trees.

Otters will be directly impacted during construction and operation. The location of the otter shelter beneath the southern traffic lights renders its loss unavoidable. Licensing procedures must be adhered to with regard to removal of the otter shelter. There will be an abrupt change at the point where the semi-natural shoreline meets the engineered structure built out onto the Loch leading to the road. Otters will have to enter the water and swim to reach the continuation of semi-natural shoreline at the other end of the structure. It is possible that they may choose to climb the structure and transit the road at this point rather than swim. The risk of this occurring must be appropriately mitigated to ensure otter road casualties are not a result of this scheme. There will be temporary disturbance to otters during the construction period - impacts such as night lighting, noise, pollution incidents and injury via vehicles / machinery being relevant to otters. Otter activity along this stretch of the Loch is known to be frequent, and may be adversely affected by the construction of an artificial structure which will effectively fragment this otherwise semi-natural shoreline. Otter activity will be monitored closely for the duration of the assessment period.

5.14.8 Pedestrians, Cyclists, Equestrians and Community

5.14.8.1 Construction Effects

All construction effects are the same as those outlined in section 5.12.8.1. Full details of the road user disruption during the construction period are provided in section 5.14.10.

5.14.8.2 Operational Effects

The Operational effects of the Shortened Viaduct scheme option are anticipated to be:-

- The proposed 2 metre footway on the east side of the length of the Shortened Viaduct will also be suitable for cyclist use – but is unlikely to be suitable for equestrians (eg insufficient path width and barrier/parapet height). The raised footway (same hard surface as the Shortened Viaduct carriageway) would provide increased safety for cyclists (as well as pedestrians) at Pulpit Rock and would satisfy the Sustrans cycling consultation response statement that 2 metre provision would provide “sufficient physical sanctuary from road traffic”. It would also satisfy the Sustrans consultation response recommendation that the width of the raised surfaced verge outwith the solid white road edge markings of the trunk road carriageway should be maximised to achieve 2m unrestricted bitmac of the same surface as the new road itself (free of drainage chamber heads, infill and other hazards). However, the provision of a raised footway on only one side of the

Shortened Viaduct would not fulfil Sustrans recommendation of provision on both the east and west sides of the new Pulpit Rock carriageway alignment and would result in north bound cyclist/pedestrian users having to traverse the A82 to access/exit the footway creating safety issues in relation to the passing vehicular traffic;

- Replacement of the small "informal layby"/verge side parking area available for use by Pulpit Rock visitors in an alternative location within proximity to the historic site would be required to maintain provision and would mitigate the permanent loss of the baseline parking availability. There is currently no such alternative provision provided in the Shortened Viaduct design option and the recommended mitigation would be for further discussions to be held to resolve the issue of replacement provision to avoid the adverse impact of permanent loss of visitor parking amenity;
- A safer journey route for locals, visitors (day, staying and transient) and local business vehicular traffic at Pulpit Rock – with the removal of potential for traffic "back-up" as the Pulpit Rock traffic lights become obsolete and unimpeded vehicle movements are provided along the new Shortened Viaduct alignment.

5.14.8.3 Mitigation

See section 5.12.8.3

5.14.9 Road Drainage and the Water Environment

5.14.9.1 Construction Effects

The construction impacts of the Shortened Option (Viaduct) are summarised in Table 5.14.6.

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Surface Water Quality	Sediment mobilisation and spillage or discharge of other pollutants in water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to area of Loch around the works, temporary)	Neutral for the unnamed watercourses & Moderate Adverse for the Loch
Flooding	Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land at the burns)	Negligible Adverse (localised to burns, temporary)	Neutral for the surrounding land
Geomorphology and Hydrology	Alteration of water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to 200m of shore, temporary) for the Loch Minor Adverse (highly localised, temporary) for Unnamed Watercourses	Moderate Adverse for the Loch & Neutral for the unnamed watercourses
Groundwater	Potential disturbance of groundwater movement	Groundwater beneath the site (Medium)	Negligible Adverse (localised to discrete points along 200m of shore & 100m of cut, temporary)	Neutral for the groundwater
	Potential contamination of groundwater	Groundwater beneath the site (Medium)	Minor Adverse (localised, temporary)	Slight Adverse for the groundwater

Table 5.14.6: Construction Impacts on water resources (Shortened Option (Viaduct))

5.14.9.2 Operational Effects

The operational impacts of the Shortened Option (Viaduct) are summarised in Table 5.14.7.

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Surface Water Quality	Discharge of road run-off to water courses/Loch	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (localised to area of dispersion, permanent)	Neutral for the unnamed watercourses & Neutral for the Loch
	Other Road and Infrastructure maintenance	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (localised, permanent)	Neutral for the unnamed watercourses & Neutral for the Loch
Flooding	Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land at the burns)	Negligible Adverse (localised to burns, permanent)	Neutral for the surrounding land
Geomorphology and Hydrology	Alteration of water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to discrete points for 200m of shore, permanent) for the Loch Minor Adverse (localised, permanent) for Unnamed Watercourses	Moderate Adverse for the Loch & Neutral for the unnamed watercourses
	Alteration to land drainage patterns	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse for both the Loch and the unnamed watercourses (localised, permanent)	Neutral for both the Loch and the unnamed watercourses
	Run-off from the scheme into watercourses	Unnamed Watercourses (Low)	Negligible Adverse for the unnamed watercourses (highly localised, permanent)	Neutral for the unnamed watercourses
Groundwater	Potential disturbance of groundwater movement	Groundwater beneath the site (Medium)	Negligible Adverse (highly local to discrete points at piles and rock cutting, permanent)	Neutral for the groundwater
	Potential contamination of groundwater	Groundwater beneath the site (Medium)	Moderate Adverse (localised, permanent)	Moderate Adverse for the groundwater

Table 5.14.7: Operational Impacts on water resources (Shortened Option (Viaduct))

Note: see Assessment Note under section 15.12.9.2.

For primary mitigation measures see 5.12.9.3

5.14.10 Disruption During Construction

Traffic delays for the Shortened Option (Viaduct) construction will be associated with the realignment of the existing road. In general, traffic will be controlled by an extension of the one-way system already in place over this section of the A82. It is expected that traffic lights and a one-way working system will be installed for the full length of the site, a total length of some 400 metres. The existing road will form the main route for through traffic while the offline parts of the new alignment are being constructed. A mandatory 30mph speed limit restriction is expected over the whole length of the works.

Full closures of approximately 14 weeks will be required for tie-in of the new viaduct to the existing road and the rock cut. During full closures, traffic will be diverted from Crianlarich through the A85-A819-A83 route via Inveraray to Tarbet.

A likely construction period of 41 weeks for the Shortened Option (Viaduct) construction is expected with temporary traffic management measures in place for the full period.

The Shortened Option (Viaduct) intrudes into the Loch and it is proposed that the viaduct construction will be carried out from floating platforms on the loch to minimize disruption to road users. Careful control measures and site management will be required and this issue is discussed in more detail in sections 5.12.7 and 9. The Shortened Option (Viaduct) also requires some construction works along the line of the existing road adjacent to Pulpit Rock.

The principal source of material to be disposed off site will arise from the viaduct sub-structure construction and the rock cut. In addition, a small volume of earthworks material will require to be imported. Delivery of materials to the site will be a matter for the construction contractor, however it is anticipated that the loch could be used for material haulage. In particular, using the loch will be of benefit for the transport of bridge deck beams which may be difficult to deliver by road.

5.15 Shortened Retaining Structure Option

5.15.1 Policies and Plans

See section 5.12.1.

5.15.2 Landscape and Visual Effects

5.15.2.1 Landscape Effects

The Shortened Retaining Structure option would involve the introduction of a similar rock cutting (80 degrees and 8.9m) to that proposed for the Shortened Option (Viaduct) but a retaining structure would be provided at the loch edge. Although the Shortened Retaining Structure would encroach into Loch Lomond it would be a less heavily engineered element than the Viaduct option. There would still be a hard, unnatural edge to the loch but it would be a smaller structure and less intrusive. There would still be no opportunity for vegetation growth on the loch edge. The proposed cutting would still be steep and high and there would be an area of fill in the vicinity of Pulpit Rock.

The proposed rock cutting together with the retaining structure would create a large man made, engineered element in the landscape. A considerable amount of vegetation will be removed to accommodate the works. There will be considerable disruption to the bank and the edge will be unsuitable for vegetation re-growth. The proposed cutting will result in a large scar on the hillside which will also not be suitable for vegetation growth. Care will need to be taken in the choice of facing materials both for the rock cutting and retaining structure. The proposed area of fill will be slightly closer to Pulpit Rock than the existing carriageway.

5.15.2.2 Visual Effects

The proposed Shortened Retaining Structure and rock cutting would introduce a new prominent element in the landscape which would be visible from a wide area. The road users would notice the widened road, the high cutting and the cut back of vegetation. Their experience of travelling through the landscape would change. They would travel faster owing to the additional carriageway and removal of traffic lights and the features in the landscape such as Pulpit Rock would become less noticeable. The road would become straighter with a more engineered and less distinctive edge.

The Shortened Retaining Structure would take travellers to the loch edge and improve the views of Loch Lomond but the cutting would introduce a hard, unnatural adjacent feature. The rock cutting and the retaining wall structure will be visible from the loch, the West Highland Way and adjacent hills although the degree of intrusion into the view will reduce with distance from the scheme. The residential properties will notice some changes to their views depending on the extent of screening by vegetation and distance from the scheme. When the Shortened Retaining Structure and rock cutting have weathered they will become less prominent features but will still be visible from a wide area as hard, engineered elements.

5.15.3 Air Quality

Pollutant levels for at local sensitive receptors for this scheme option are the same as those given in 5.12.3.

The total pollution emissions in 2011 and 2026 for traffic in the regional air quality study area with the Retaining Structure option in place are provided in Table 5.15.4.

Year	Tonnes/yr				
	CO	THC	NO _x	PM ₁₀	C
2011	0.68 (-0.05)	0.09 (-0.01)	0.56 (+0.06)	0.02 (<0.01)	58.73 (+7.57)
2026 [#]	0.77 (-0.07)	0.10 (-0.01)	0.50 (+0.06)	0.01 (<0.01)	65.08 (+7.53)

Table 5.15.4: Retaining Structure Total Annual Pollution Emissions

[#] Values calculated using 2026 data but with emissions factors for 2025, as this is the current limit of the DMRB Screening Tool

Based on the negligible change in total pollution emission and the absence of any relevant sensitive receptors, air quality should not be considered a significant factor for this scheme option. A further simple or detailed level assessment is not considered to be required.

5.15.4 Traffic Noise and Vibration

A 3d design of the Retaining Structure option has not been available. Without such a design it is not possible to predict traffic noise levels. However, the design team have advised that this option is physically similar to the Shortened Option (Viaduct), therefore, the 3d design of the Shortened Option (Viaduct) has been used with the traffic data for the Retaining Structure option to give an indication of the likely impact on traffic noise levels.

Based on the above approach the predicted free-field noise levels at the Pulpit Rock SM with the Retaining Structure option in place for the 2026 scenario are presented in Table 5.15.5 below.

Receptor	Traffic Noise Level $L_{A10,18h}$ dB
	2026
1: Pulpit Rock SM	51.5

Table 5.15.5: Retaining Structure Traffic Noise Levels

The noise levels generated by the road traffic are predicted to decrease by 0.5 dB with this option in place. This is due to a number of factors. The increase in speed of the road traffic from the baseline to the with scheme situations will increase noise levels, but the increase in speed is sufficient to be above the 75 km/h level at which the road surface correction changes from -1.0 dB to -3.5 dB, which will cause a decrease in noise levels. Additionally, the change in alignment of the road will alter the level of screening provided to the receptor by the terrain. This is a beneficial change of negligible significance, especially considering that a SM is less sensitive to traffic noise changes than residential properties. Noise should not be considered a significant factor for this scheme option.

5.15.5 Land Use

5.15.5.1 Land Use Impact

There would be no permanent severance to properties or fields, although there may be temporary interference during construction with access to land via the sheep creep under the railway line during construction, and to land around Pulpit Rock itself.

The amount of land-take which would be required for the Shortened Retaining Structure option is estimated at around 5290m². Some of this area is woodland (not designated as Ancient Woodland), but is described by the Argyll and Bute Local Biodiversity Action Plan as "Upland Oakwood", which is characterised by a canopy mainly of oak and birch with holly, rowan and hazel making up the under-storey. The loss of a small amount of land for this habitat has been assessed as a minor adverse impact.

This option would require the least amount of additional land take compared to other options as this option is effectively using and widening the current alignment. This option would involve a small amount of cutting and filling. There would be a small impact on the Loch as the bottom of the retaining structure would be in contact with the mean level of the Loch.

5.15.5.2 Land Use Mitigation

See section 5.12.5.2

5.15.6 Archaeology and Cultural Heritage

The new Shortened Retaining Structure route option as it passes in front of Pulpit Rock would be on broadly the same alignment as the current road. Although more extensive embankments would be visible from the Rock they would not encroach upon the enclosed land area in which the Rock is located. There would be some cutting back into the rock face to the immediate southeast of the Rock, but this would not significantly open up the enclosed landscape around the Rock. The Shortened Retaining structure would not be visible from the Rock.

It is, therefore, considered that this option would not cause a significant change to the setting of Pulpit Rock.

This option would not have a direct effect on the Tarbet to Crianlarich Military Road.

5.15.7 Ecology and Nature Conservation

For effects common to all options see section 5.12.7.

The Shortened Retaining Structure option would involve online widening of the carriageway with both cutting into the rock face to the west of the existing road and building a structure out onto the Loch. This option will involve a new cut slope set at an angle of 80 degrees. The steeper slope will result in a smaller cutting of approximately 8.9 metres in height. The option includes a retaining structure (rather than a viaduct) for the carriageway which is kept closer into the slope away from the edge of the loch and is approximately 175 metres in length and the improvements to the existing road extend a further 185 metres.

No significant or direct impacts would be expected upon Pollochro Woods SSSI or Ben Vorlich SSSI. There will not be encroachment upon either of the ancient woodland sites identified within the wider area.

There will be permanent terrestrial and Loch substratum land take associated with this option and the habitats that are likely to be directly and permanently lost include a substantial area of cliff from the hill to the west of the road, scattered trees (mainly birch but also oak and alder) on both the cleared cliff and the shoreline, scrub and understorey assemblages including the uncommon moss, *Dicranum scottianum* and liverwort, *Harpanthus scutatus*. The shoreline and littoral substratum of the Loch will be lost where the submerged structure encroaches out into the Loch. These permanent habitat losses increase the potential for severance and fragmentation of these habitats, and lower the capacity for natural regeneration of these habitat assemblages after the completion of works within the wider shoreline context.

Appropriate mitigation measures will have to be adopted where the stands of Japanese knotweed are implicated – full eradication will be required prior to works.

This option will affect two areas of trees with potential for roosting bats. There are mature oak trees on either side of the road between the traffic lights, and areas of mixed broadleaved woodland with mature trees to the north of the traffic lights. Permanent loss of these trees due to construction would reduce the overall capacity of the area to harbour bats, alongside temporary indirect disturbance to roosting bats in the wider area due to construction noise. Further checks for bat roosts and activity are necessary to determine whether there is potential for bats within these trees.

Otters will be directly impacted during construction and operation. The location of the otter shelter beneath the southern traffic lights renders its loss unavoidable. Licensing procedures must be adhered to with regard to removal of the otter shelter. There will be an abrupt change at the point where the semi-natural shoreline meets the engineered structure built out onto the Loch leading to the road. Otters will have to enter the water and swim to reach the continuation of semi-natural shoreline at the other end of the structure. It is possible that they may choose to climb the structure and transit the road at this point rather than swim. The risk of this occurring must be appropriately mitigated to ensure otter road casualties are not a result of this scheme. There will be temporary disturbance to otters during the construction period - impacts such as night lighting, noise, pollution incidents and injury via vehicles / machinery being relevant to otters. Otter activity along this stretch of the Loch is known to be frequent, and may be adversely affected by the construction of an artificial structure which will effectively fragment this otherwise semi-natural shoreline. Otter activity will be monitored closely for the duration of the assessment period.

5.15.8 Pedestrians, Cyclists, Equestrians and Community

5.15.8.1 Construction Effects

All construction effects are the same as those outlined in section 5.12.8.1. Full details of the road user disruption during the construction period are provided in section 5.15.10.

5.15.8.2 Operational Effects

The Operational effects of the Shortened Retaining Structure scheme option are anticipated to be:-

- The proposed 2 metre footway on the east side of the length of the Shortened Retaining Structure will also be suitable for cyclist use – but is unlikely to be suitable for equestrians (e.g. insufficient path width and barrier/parapet height). The raised footway (same hard surface as the Shortened Retaining Structure carriageway) would provide increased safety for cyclists (as well as pedestrians) at Pulpit Rock and would satisfy the Sustrans cycling consultation response statement that 2 metre provision would provide “sufficient physical sanctuary from road traffic”. It would also satisfy the Sustrans consultation response recommendation that the width of the raised surfaced verge outwith the solid white road edge markings of the trunk road carriageway should be maximised to achieve 2m unrestricted bitmac of the same surface as the new road itself (free of drainage chamber heads, infill and other hazards). However, the provision of a raised footway on only one side of the Shortened Retaining Structure would not fulfil Sustrans recommendation of provision on both the east and west sides of the new Pulpit Rock carriageway alignment and would result in north bound cyclist/pedestrian users having to traverse the A82 to access/exit the footway creating safety issues in relation to the passing vehicular traffic;
- Replacement of small “informal layby”/verge side/ parking area available for use by Pulpit Rock visitors in an alternative location within proximity to the historic site would be required to maintain provision and would mitigate the permanent loss of the baseline parking availability. There is currently no such alternative provision provided in the Shortened Retaining Structure design option and the recommended mitigation would be for further discussions to be held with Transport Scotland and

the LLTNPA to resolve the issue of replacement provision to avoid the adverse impact of permanent loss of visitor parking amenity; and

- Safer journey route for locals, visitors (day, staying and transient) and local business vehicular traffic at Pulpit Rock – with the removal of potential for traffic “back-up” as the Pulpit Rock traffic lights become obsolete and unimpeded vehicle movements are provided along the new Shortened Retaining Structure alignment.

5.15.8.3 Mitigation

See section 5.12.8.3

5.15.9 Road Drainage and the Water Environment

5.15.9.1 Construction Effects

The construction impacts of the Shortened Retaining Structure Option are summarised in Table 5.15.6.

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Surface Water Quality	Sediment mobilisation and spillage or discharge of other pollutants in water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to area of Loch around the works, temporary)	Neutral for the unnamed watercourses & Moderate Adverse for the Loch
Flooding	Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land at the burns)	Negligible Adverse (localised around the burns, temporary)	Neutral for the surrounding land
Geomorphology and Hydrology	Alteration of water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to 200m of shore & mostly above mean Loch level, temporary) for the Loch Minor Adverse (highly localised, temporary) for Unnamed Watercourses	Largely Adverse for the Loch & Neutral for the unnamed watercourses
Groundwater	Potential disturbance of groundwater movement	Groundwater beneath the site (Medium)	Minor Adverse (localised to 200m along shore & 100m of cut, temporary)	Slight Adverse for the groundwater
	Potential contamination of groundwater	Groundwater beneath the site (Medium)	Minor Adverse (localised, temporary)	Slight Adverse for the groundwater

Table 5.15.6: Construction Impacts on water resources (Shortened Retaining Structure option)

5.15.9.2 Operational Effects

The operational impacts of the Shortened Retaining Structure Option are summarised in Table 5.15.7.

General Issue	Specific Issues	Receptor & sensitivity	Magnitude (and type) of effect	Overall significance
Surface Water Quality	Discharge of road run-off to water courses/Loch	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (localised to area of dispersion, permanent)	Neutral for the unnamed watercourses & Neutral for the Loch
	Other Road and Infrastructure maintenance	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse (localised, permanent)	Neutral for the unnamed watercourses & Neutral for the Loch
Flooding	Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land at the burns)	Negligible Adverse (localised to burns, permanent)	Neutral for the surrounding land
Geomorphology and Hydrology	Alteration of water bodies	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Minor Adverse (localised to 200m of shore, permanent) for the Loch Minor Adverse (highly localised, permanent) for Unnamed Watercourses	Neutral for both the Loch & the unnamed watercourses
	Alteration to land drainage patterns	Loch Lomond (Very High) and Unnamed Watercourses (Low)	Negligible Adverse for both the Loch and the unnamed watercourses (localised, permanent)	Neutral for both the Loch and the unnamed watercourses
	Run-off from the scheme into watercourses	Unnamed Watercourses (Low)	Negligible Adverse for the unnamed watercourses (highly localised, permanent)	Neutral for the unnamed watercourses
Groundwater	Potential disturbance of groundwater movement	Groundwater beneath the site (Medium)	Moderate Adverse (localised to 200m length of structure & rock cut, permanent)	Moderate Adverse for the groundwater
	Potential contamination of groundwater	Groundwater beneath the site (Medium)	Moderate Adverse (localised, permanent)	Moderate Adverse for the groundwater

Table 5.15.7: Operational Impacts on water resources (Shortened Retaining Structure option)

Note: see Assessment Note under section 15.12.9.2.

For primary mitigation measures see 5.12.9.3

5.15.10 Disruption During Construction

Traffic delays for the Shortened Retaining Structure option construction will be associated with the realignment of the existing road. In general, traffic will be controlled by an extension of the one-way system already in place over this section of the A82. It is expected that traffic lights and a one-way working system will be installed for the full length of the site, a total length of some 400 metres. The existing road will form the main route for through traffic while the offline parts of the new alignment are being constructed. A mandatory 30mph speed limit restriction is expected over the whole length of the works.

Full closures of approximately 18 weeks will be required for tie-in of the new viaduct to the existing road and the rock cut. During full closures, traffic will be diverted from Crianlarich through the A85-A819-A83 route via Inveraray to Tarbet.

A likely construction period of 47 weeks for the Shortened Retaining Structure option construction is expected with temporary traffic management measures in place for the full period.

The Shortened Retaining Structure option intrudes into the Loch and it is proposed that the wall construction will be carried out from floating platforms on the loch to minimize disruption to road users. Careful control measures and site management will be required and this issue is discussed in more detail in sections 5.12.7 and 9. The Shortened Retaining Structure option also requires some construction works along the line of the existing road adjacent to Pulpit Rock.

The principal source of material to be disposed off site will arise from the rock cut. In addition, earthworks material will require to be imported, in particular to backfill the wall. Delivery of materials to the site will be a matter for the construction contractor, however it is anticipated that the loch could be used for material haulage.

5.16 Environmental Assessment Summary

The final section of the Environmental Assessment chapter provides a summary of the key environmental impacts for the four design options considered in this report (Viaduct; Tunnel; Shortened Viaduct and Shortened Retaining Structure). For ease of reference, these are set out in the same environmental topic sequence as sections 5.12 to 5.15 inclusive.

5.16.1 Policies and Plans

It is thought that the requirement and support for the implementation of each of the four main Scheme options through regional and local plan policies and proposals override the policies contained within the national planning policy documents where there is a conflict, although where possible the Scheme will comply with national policies.

Mitigation measures have been outlined in each of the specific environmental topic sections within this report. However, detrimental effects in terms of policy implementation will be reduced or avoided by implementing best practice standards during construction, so that the scheme can contribute more appropriately to policies.

In summary, the Scheme to upgrade the A82 north of Tarbet is generally supported at all policy and plan levels (national, regional and local) – irrespective of the technical design

solutions – although the Argyll & Bute Local Transport Strategy supports the provision of a Tunnel at Pulpit Rock.

The Scheme would conflict with other policies with regards to natural habitats, landscape and cultural heritage features, although mitigation measures would be employed to avoid reduce or offset any adverse impacts resulting from the implementation of the Scheme.

5.16.2 Landscape and Visual Effects

From both the landscape and visual effects perspective, the Tunnel option would have the least impact as it would not encroach into Loch Lomond and therefore will be less intrusive than the other options. Although some vegetation will need to be removed to accommodate the possibility of Tunnel blasting, less vegetation will be removed from the loch side and from the rock face than for the other options. This option would also offer less visual intrusion to the wider landscape than the other options. The advantages of the Tunnel are that it offers relatively minor disruption to the existing landscape and would add to the drama of the landscape experience. The disadvantages are that the horizontal alignment of the road would be evened out and there would be a risk of light pollution in the rural landscape because the Tunnel would need to be lit.

The greatest landscape and visual impact would be created by the Viaduct design option. It provides the most heavily engineered solution that will give a hard, unnatural edge to Loch Lomond creating a prominent new feature in the landscape and involving considerable disruption to the Loch bank and vegetation growth. If this option is to be taken further the design should be developed to create a bold, simple, sculptural structure which would positively contribute to the National Scenic Area, be of the design quality expected in a nationally designated area and complement the large scale landscape and sweeping curves of the road. The Shortened Option (Viaduct) would also create a prominent new feature in the landscape but it would be less intrusive than the Viaduct option because it doesn't go all the way round the rock outcrop and therefore its position is less prominent.

Both the Viaduct schemes will be visible and form a prominent feature from the Loch and the West Highland Way and adjacent hills. When the structures have weathered they will become less prominent features but will still be visible as hard, engineered edges to Loch Lomond.

Although the Shortened Retaining Structure option would encroach into Loch Lomond it would be a less heavily engineered element than both the Viaduct options. There would still be a hard, unnatural edge to the loch but it would be a smaller structure and less intrusive. This option would provide no opportunity for vegetation growth on the loch edge.

5.16.3 Air Quality

For all of the options Air Quality should not be considered a Significant factor due to the negligible change in total pollution emissions and the absence of any relevant sensitive receptors. Further simple or detailed level assessments are not considered to be required.

5.16.4 Traffic Noise and Vibration

For all of the options Traffic Noise and Vibration should not be considered a Significant factor especially as a Scheduled Monument is less sensitive to traffic noise changes than

residential properties (the closest residential properties to Pulpit Rock are at [REDACTED] over 800m to the north, and [REDACTED] over 1400m to the south).

5.16.5 Land Use

None of the four main design options would create permanent severance to properties or fields, although there may be temporary interference during construction with access to land via the sheep creep under the railway line during construction, and to land around Pulpit Rock itself.

The amount of woodland and scrub which would be lost from Scheme implementation is notionally estimated at being in the order of around 4780m² (Tunnel option) to approximately 5350m² (Viaduct option). Some of the required land-take area is woodland (not designated as Ancient Woodland), but is described by the Argyll and Bute Local Biodiversity Action Plan as “Upland Oakwood”, which is characterised by a canopy mainly of oak and birch with holly, rowan and hazel making up the under-storey. The loss of a small amount of this habitat has been assessed as a Minor Adverse impact.

In terms of land-take, the greatest impact would be the Viaduct option with the Tunnel option creating the least land-take impact. In addition, the Viaduct option would have the largest direct impact on Loch Lomond with the Tunnel option having the least effect (ie no direct impact).

5.16.6 Archaeology and Cultural Heritage

None of the four main design options is predicted to have a significant effect on the known cultural heritage resource.

The archaeological potential of the area is considered generally to be low. The summit of the hill above the current road is considered to be of moderate archaeological potential. If surface works are required on the summit of the hill for the Tunnel option, then this option would be considered to have a greater potential to reveal hitherto undiscovered archaeological remains than the three other main design options. If surface works were not required on the hill summit for the Tunnel option, then all four main design options would be considered to have equal potential to reveal hitherto undiscovered archaeological remains. The adoption of a suitable programme of archaeological works would be sufficient to assess the archaeological potential for any of the options and allow development to proceed.

There are no archaeology or cultural heritage grounds that would preclude the adoption of any of the four main design options.

5.16.7 Ecology and Nature Conservation

From an ecological and nature conservation perspective the Tunnel is the least harmful design option, requiring the least amount of permanent land take and no encroachment out onto the Loch. Habitats that are likely to be directly and permanently lost include the area of cliff and hillside where the entrance and exit points of the tunnel will be located together with scattered trees (mainly birch but also oak and alder) and scrub from the hillside and existing road verges leading up to the tunnel. Appropriate mitigation measures would have to be adopted where the stands of Japanese knotweed are implicated – full eradication will be

required prior to the Tunnel works – but this mitigation requirement for the Japanese Knotweed also applies to the other three main design options.

The Tunnel option would also affect fewer trees with potential for roosting bats compared with the other design options – although the impacts upon bat species during operation of the Tunnel scheme will depend, in part, on the extent to which the tunnel needs to be lit for safety reasons. A further assessment of the impact of lighting on bat feeding behaviour (and bird feeding behaviour) would therefore be required if the Tunnel option is progressed further.

For all of the Scheme options, water quality along the Loch Lomond shoreline and the small burn flowing to the north of the traffic light may be compromised due to run-off from the Tunnel construction and operation impacts. Nonetheless it is likely these impacts can be mitigated through sound site management procedures. The Tunnel option would be the only design option where there is no necessity to lose any of the shoreline or littoral habitat associated with Loch Lomond, therefore potential adverse impacts upon fish would be limited to pollution only during the Tunnel construction. There is a confirmed poawan breeding population within 500m of Pulpit Rock and highly suitable poawan breeding habitat to the north of Pulpit Rock. Consideration should also be given to a breeding lamprey population that was recorded to the north of Pulpit Rock (See [Appendix A2](#) for detailed legislative background).

Otters may be indirectly impacted during construction of the Tunnel option although there would be no requirement for the demolition of the existing Otter shelter beneath the Pulpit Rock southern traffic light installation. For all of the other three main design options Otters will be directly impacted during Scheme construction and Scheme operation with the location of the Otter shelter beneath the southern traffic lights rendering its loss unavoidable for the proposed Viaduct, Shortened Viaduct and Retaining Structure options. For the Tunnel option, the Loch shoreline will not have to be modified to accommodate the Tunnel, so otter foraging activity will not be adversely affected. There would be, however, the likelihood of temporary disturbance to otters during the Tunnel construction period.

Depending on the timing of all four of the construction works, there may be potential impacts upon breeding birds using the woodland and scrub habitats which would be applicable to all of the four options under consideration.

5.16.8 Pedestrians, Cyclists, Equestrians and Community

During the Construction phase for each of the four Scheme options the following would be applicable:-

- Temporary significant extended local journey times for residents, tourists, leisure and business related traffic who currently use the A82 to access community, business, tourism and recreation receptors/locations between Tarbet and Crianlarich;
- Temporary (and significant) severance of pedestrian, cycle, and equestrian user access along the section of the A82 at Pulpit Rock during the Scheme options construction period;
- Permanent loss of the existing small “informal lay-by”/verge side parking area currently available for use by Pulpit Rock historic site visitors.

In addition, it is anticipated that during the construction phase:-

- Only the Tunnel design option would have no construction impact on leisure craft navigating Loch Lomond (in proximity to the west shore at Pulpit Rock); and
- Only the Tunnel design option would be likely to have a construction effect (temporary impact) on the scheduled West Highland Railway passenger journeys.

During the Operational phase for each of the four Scheme options the following would be applicable:-

- Permanent loss of the small verge side/lay-by parking area used by Pulpit Rock visitors; and
- A safer journey route for locals, visitors (day, staying and transient) and local business vehicular traffic at Pulpit Rock – with the removal of potential for traffic “back-up” as the Pulpit Rock traffic lights become obsolete and unimpeded vehicle movements are provided along the new Scheme option alignments.

In addition, during the operational period for each of the four Scheme options, only the Tunnel design option would fail to meet the expressed Sustrans cycling provision requirements (2 metre width provision). Both the Viaduct design options and the Retaining Structure design option would provide a path of 2 metres in width. The raised footway for these three options would provide increased safety for cyclists (as well as pedestrians) by providing increased separation from motorised road traffic at Pulpit Rock.

However, the provision of a raised footway on only one side of the Viaduct, Shortened Viaduct and Retaining Structure options would not fulfil Sustrans recommendation of provision on both the east and west sides of the new Pulpit Rock carriageway alignment and would result in north bound cyclist/pedestrian users having to traverse the A82 to access/exit the footway creating safety issues in relation to the passing vehicular traffic.

5.16.9 Road Drainage and the Water Environment

In terms of overall impacts on the water environment the predicted significance of the effects are quite similar for all of the options considered. There are however a number of key areas where there are some significant differences in the significance of the effects.

Considering the Construction stage effects in isolation there is a defined hierarchy from the Tunnel (least impact on water environment) to the Viaducts to the Retaining Structure (most impact on the water environment). This hierarchy is mainly determined by impacts on the geomorphology of the Loch shore i.e. loss or degradation of the shoreline.

Considering the Operational phase in isolation there is no clear hierarchy from least impact to most impact. This is because the variations in the significance of the geomorphological effects between the different options are effectively offset by the variations in the significance of effects on groundwater (i.e. options with higher geomorphological impacts typically have lower groundwater impacts, whereas options with lower geomorphological impacts have higher groundwater impacts).

Further detailed assessment will be required at the next stage once more detailed design information and finalized ground investigation data is available, to confirm the assessment of effects. A number of potentially significant adverse effects have been reported in this assessment, but it is anticipated that with more detailed information and consideration of

secondary mitigation measures for inclusion in the design and construction stages there is potential for a number of the potentially significant adverse effects to be reduced.

5.16.10 Disruption During Construction

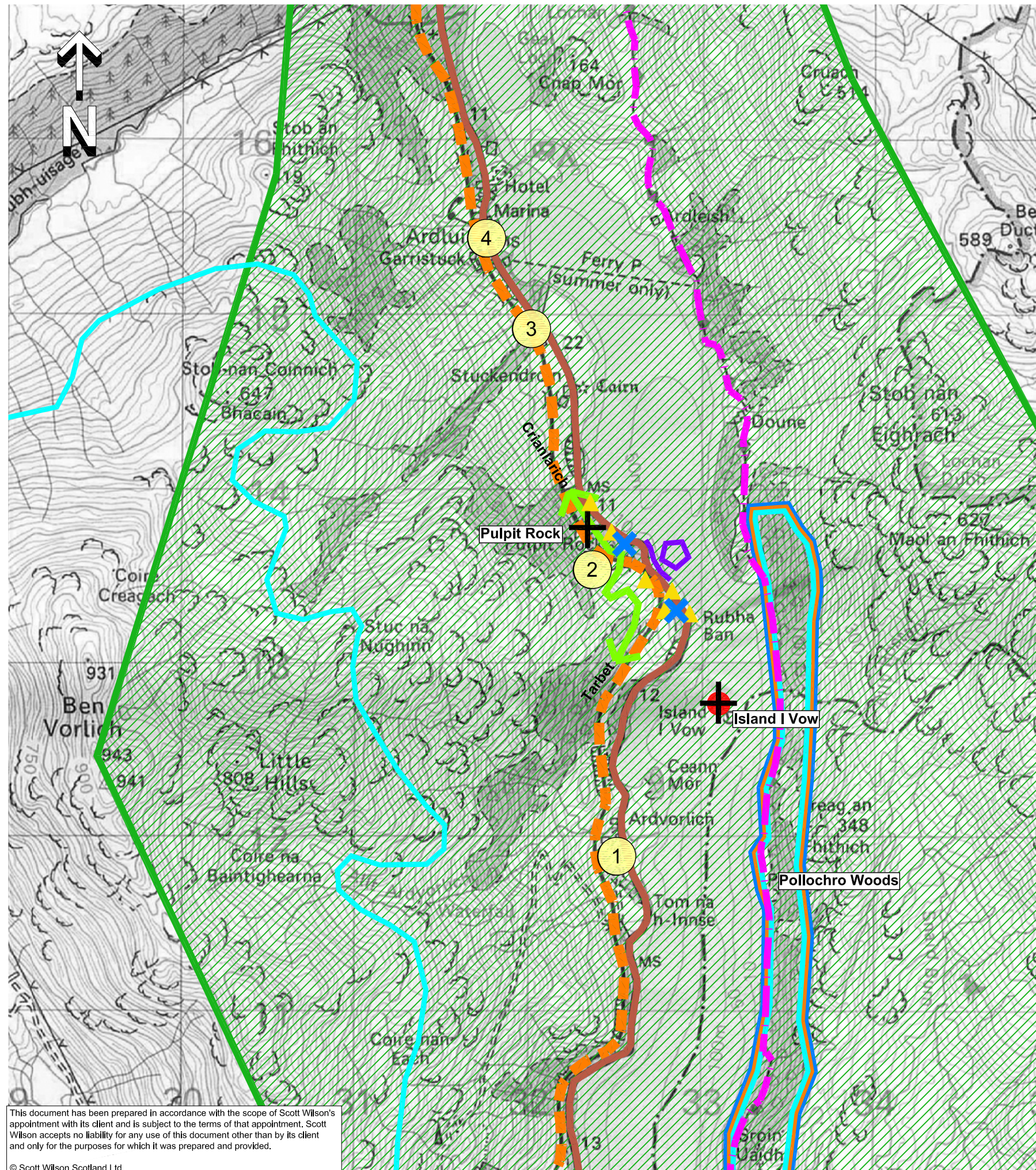
For all options, there will be major traffic delays associated with the construction works. For all options, traffic will be controlled by an extension of the one-way system already in place over this section of the A82. It is expected that traffic lights and a one-way working system will be installed for the full length of the site, a total length of approximately 400 metres. A mandatory 30mph speed limit restriction is expected over the whole length of the works.

The total construction disruption timescales are likely to range from 43 weeks (Shortened Option (Viaduct)) to 65 weeks (Tunnel option). However, full closures of the A82 would be required for a partial period for all of the options, ranging from 10 weeks for the Viaduct option to 24 weeks for the Tunnel option. During these full closure periods, traffic would be diverted between Tarbet and Crianlarich via the A83, A819 and the A85.

With the exception of the Tunnel option, all options intrude into the loch, with the greatest intrusion being for the Viaduct option. For these options, construction will be carried out from floating platforms on the loch to minimise disruption to road users and hence the construction issues will be broadly similar for each of the non-tunnel options. In contrast, the Tunnel option requires the most construction works in proximity to Pulpit Rock, albeit all works are at a manageable distance.

All options require the disposal of materials off site. The minimum volume is with the Viaduct option which is limited to arisings from sub-structure construction. The volume increases for the Shortened Viaduct and Shortened Retaining Structure options where the rock cut arisings will require disposal. The greatest volume of material for disposal will arise from the tunnel construction.

All options will require the import of construction materials. Although delivery of materials to the site will be a matter for the construction contractor, it is anticipated that the loch could be used for material haulage. In particular, using the loch will be of benefit for the transport of bridge deck beams which may be difficult to deliver by road. The opportunities and likelihood of use of the loch for haulage is deemed to be greatest with those options that require the provision of working platforms on the loch. Whilst possible with the Tunnel option, it is considered that it may be less attractive to use the loch for haulage.



LEGEND

- ① Ardvorlich
-Ardvorlich House B&B
-Ardvorlich Cottage (residence)
 - ② Pulpit Rock
-Historic Rock
-Cyclist controlled traffic lights
-A82 verge side parking (c.2 cars)
 - ③ Stuckendroin to Ardlui
-Residential properties (x4)
 - ④ Ardlui
-Residential properties (x6)
-Ardlui Hotel, Marina, lodges and Holiday Home Park
-Shop (seasonal)
-Bus stop (Ardlui Hotel)
-Rail Station (West Highland Line)
-Ardlui to Ardluish (Seasonal ferry)
-Road side path sections
- National Scenic Area
 - Ancient Woodland
 - Special Area of Conservation
 - Site of Special Scientific Interest
 - Scheduled Monument
 - Listed Building
 - Glasgow - Fort William West Highland Railway
 - West Highland Way
 - A82
 - Section of Tarbet - Crianlarich Military Road [un-designated site of archaeological interest]
 - Japanese Knotweed
 - Otter Shelter/Couch Site
 - Otter Spraint/Activity
 - Tree with Bat Roost Potential

Note: The entire mapped area is situated within the Loch Lomond and the Trossachs National Park.

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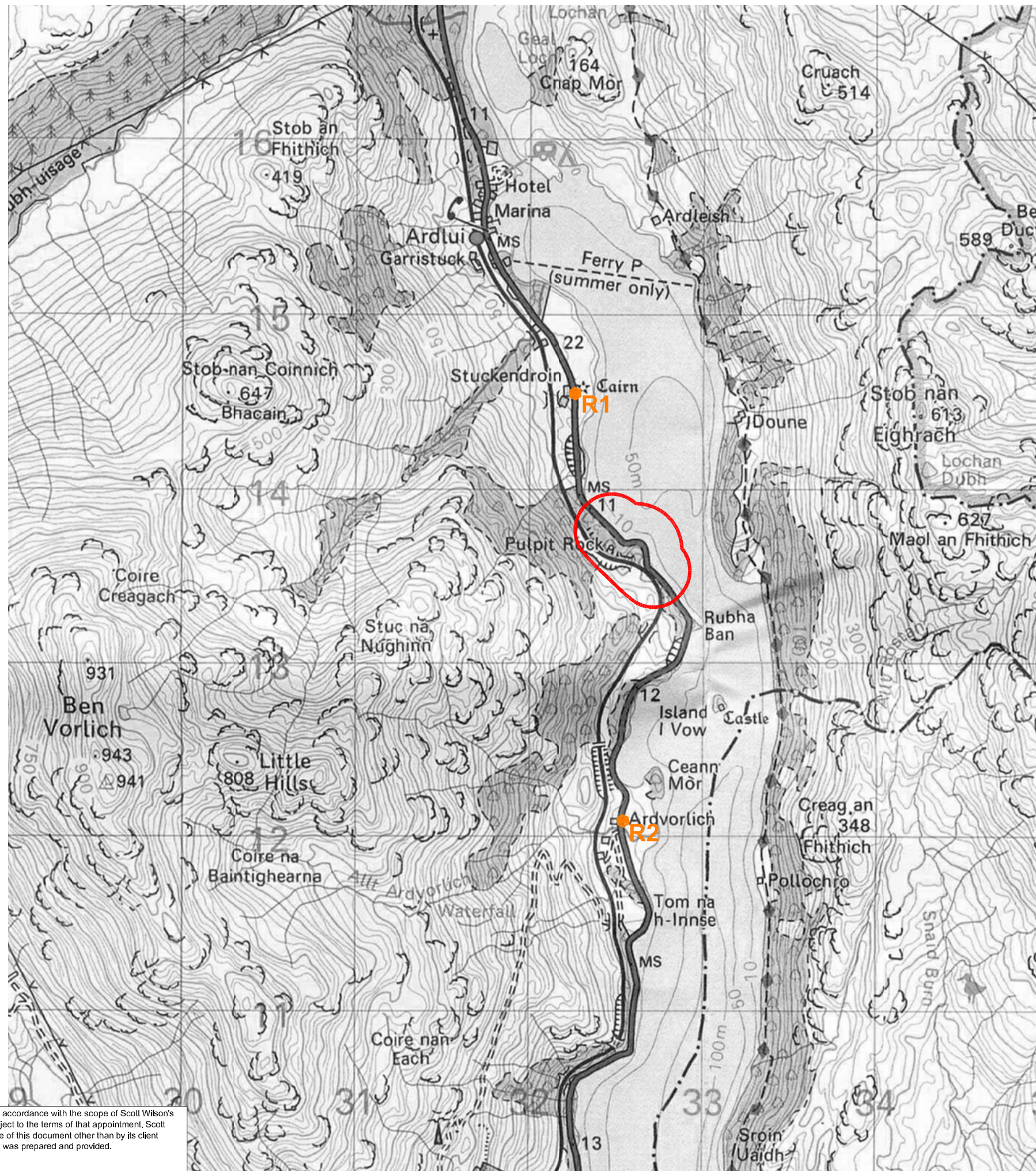
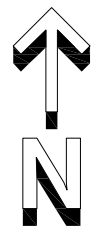
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A82 Pulpit Rock



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FIGURE 5.1
Environmental Constraints Map

Scale: 1:25000



LEGEND

-  200m Study Area
-  Receptor Location

Note: The entire mapped area is situated within the Loch Lomond and the Trossachs National Park.



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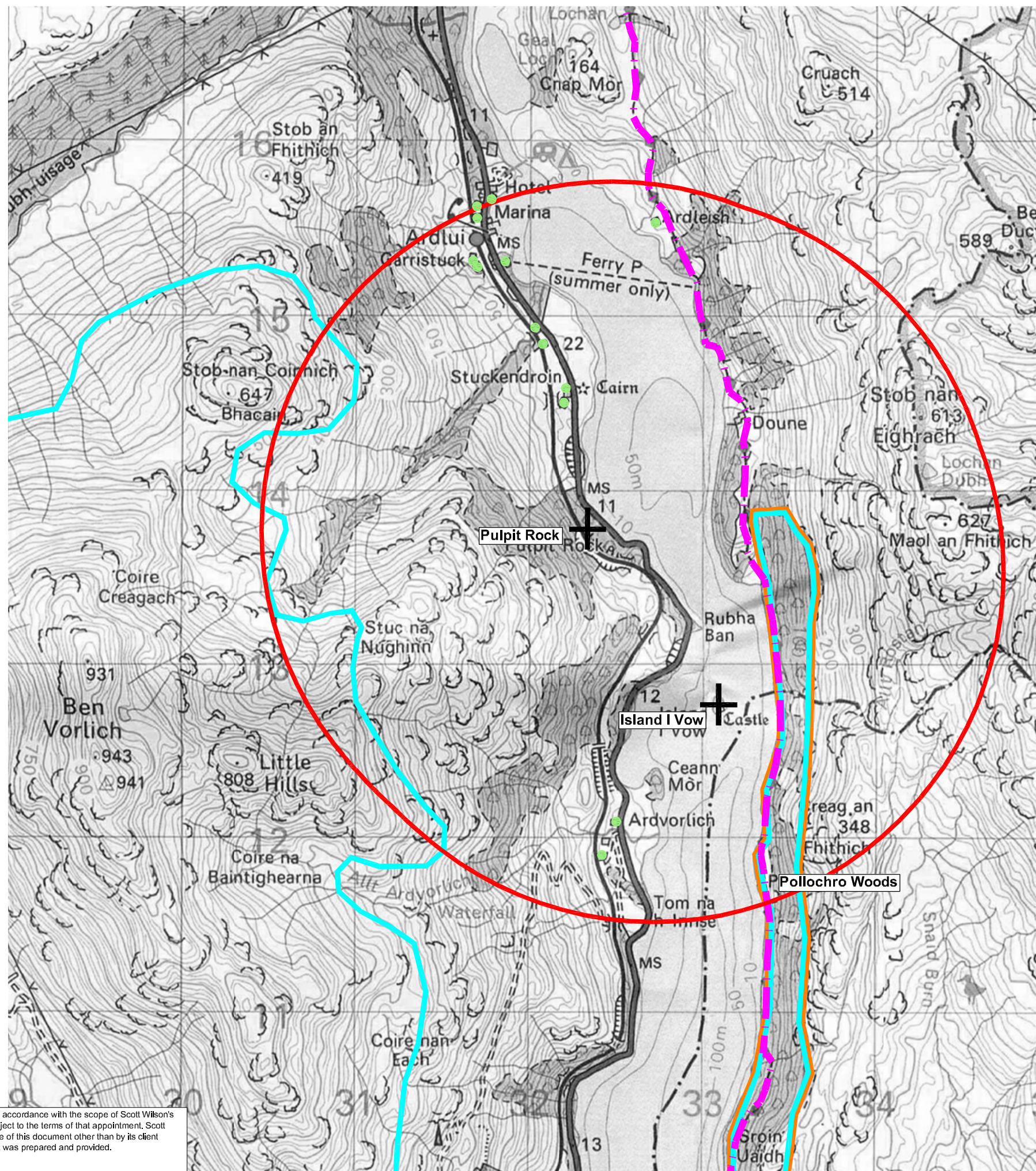
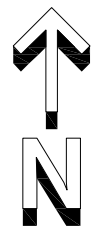
FIGURE 5.2

Air Quality

Scale: 1:25000

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LEGEND

-  Special Area of Conservation
-  Site of Special Scientific Interest
-  Scheduled Monument
-  West Highland Way
-  2km Study Area
-  Residential Properties Located Within Study Area

Note: The entire mapped area is situated within the Loch Lomond and the Trossachs National Park.



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FIGURE 5.3
Traffic Noise and Vibration

Scale: 1:25000

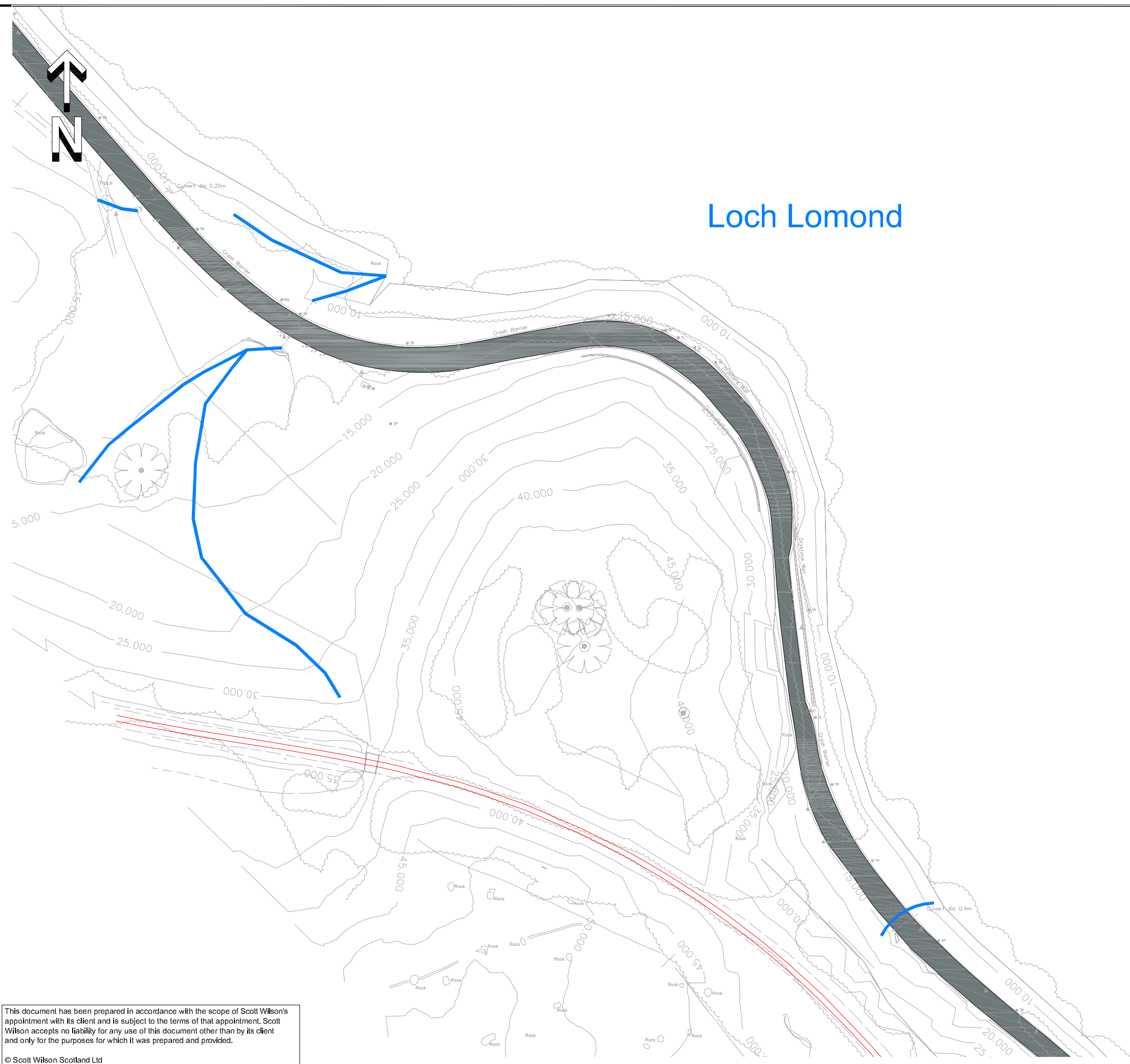
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Loch Lomond

LEGEND

-  Un-named Watercourse
-  A82
-  West Highland Railway

Note: The entire mapped area is situated within the Loch Lomond and the Trossachs National Park.



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FIGURE 5.4
 Road Drainage and the Water Environment

Scale: 1:1000

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FIGURE 5.5 - Landscape Character Photos sheet 1



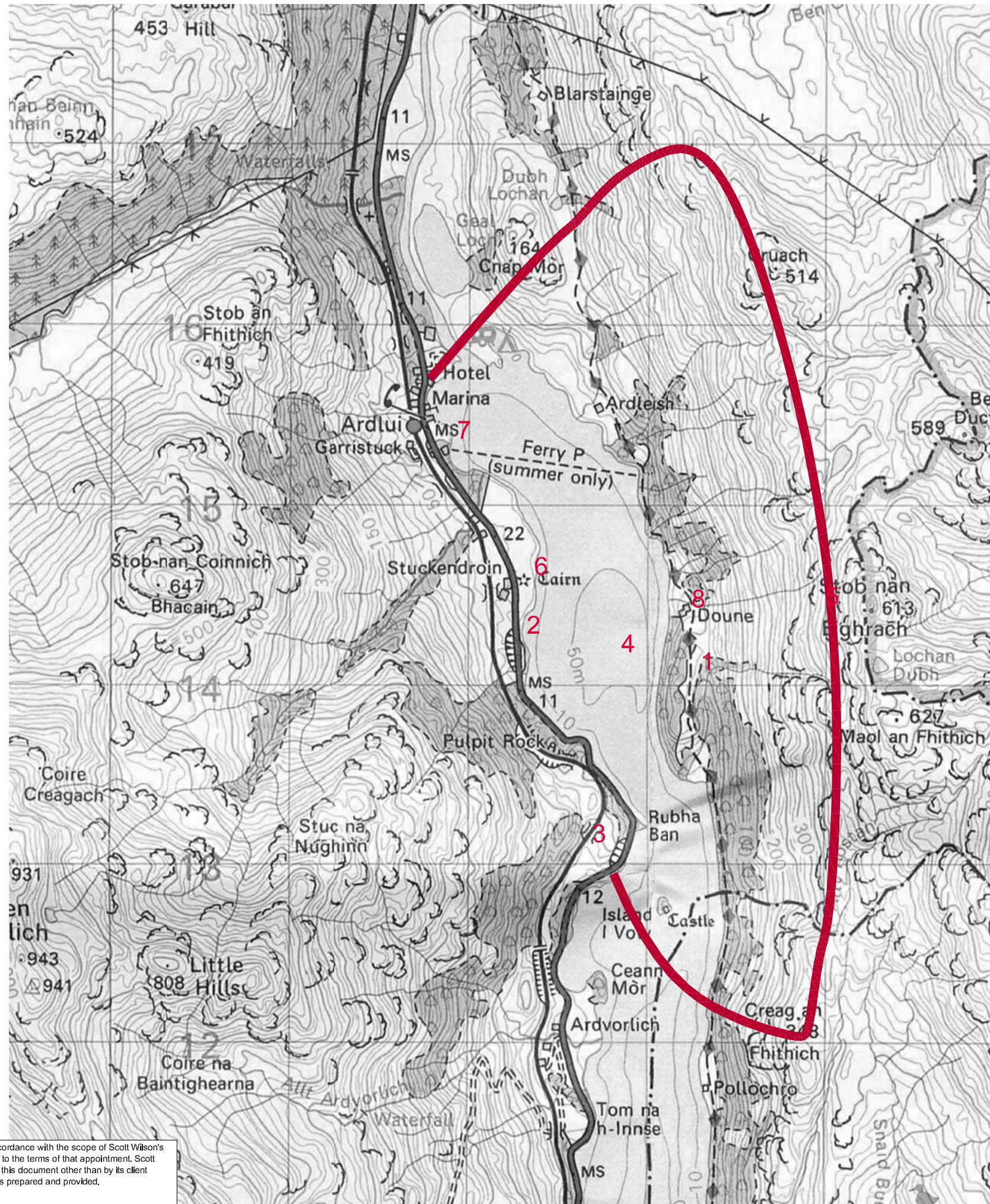
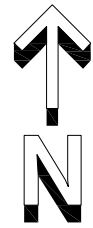
FIGURE 5.5 - Landscape Character Photos sheet 2




FIGURE 5.5 - Landscape Character Photos sheet 3



FIGURE 5.5 - Landscape Character Photos sheet 4



LEGEND

 Zone of Visual Influence



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FIGURE 5.6
Visual Analysis

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6.0 Traffic and Economic Assessment

6.1 Background

This section outlines the main findings of the traffic and economic assessment for the four Scheme Options. Details of this assessment can be found in:

A82 Pulpit Rock Improvement Traffic and Economic Assessment Report November 2009.

This report provides a complete set of results of the Stage 2 Traffic and Economic Assessment. It details the development of the local traffic model that has been used as the basis of the economic appraisal, traffic growth forecasting assumptions and the results of the operational and economic appraisals.

6.2 Modelling Overview

The quantitative assessment of the transport economic efficiency and road safety aspects of a proposed road improvement requires the development and application of various computer models. In the case of the A82 Pulpit Rock appraisal, this has involved the development of a NESAs and QUADRO model.

The computer models serve the following specific functions:

- The NESAs (Network Evaluation from Surveys and Assignments) model was developed to compare the cost and road user benefits of the proposed improvement options taking into account both transport economic efficiency and road safety issues; and
- The QUADRO (Queues and Delays at Roadworks) model was developed to examine the road user delays and works costs associated with the construction of the improvement options and future road maintenance requirements.

6.3 The NESAs Model

6.3.1 The NESAs Do-Minimum Network

The Do-Minimum network is the base road network against which the Do-Something options are assessed. In the case of the A82 Pulpit Rock Improvement, the Do-Minimum network is the same as the Do-Nothing network.

The modelled network includes the A82 trunk road between approximately 290 metres south of the southern signal head to approximately 320 metres north of the northern signal head at Pulpit Rock. The network consists of 2 zones, 5 nodes and 4 links, with 1 modelled signalised junction.

The model is based on the 12-hour weekday traffic flows, input as an all-vehicle trip matrix, and a corresponding 12-hour vehicle composition derived from information collected in May 2007.

The 12-hour vehicle composition used in the model is as follows:

- 78.9% - Cars;
- 12.2% - Light Goods Vehicles (LGV);
- 5.1% - Other Goods Vehicles 1 (OGV1);
- 1.8% - Other Goods Vehicles 2 (OGV2); and
- 2.0% - Passenger Service Vehicles (PSV).

6.3.2 The NESA Do-Something Networks

The Do-Something networks are the options defined in Section 2 of this report. The networks consist of the following:

- Viaduct Option – 2 zones, 4 nodes and 3 links;
- Tunnel Option – 2 zones, 6 nodes and 5 links;
- Shortened Option (Viaduct) – 2 zones, 8 nodes and 7 links; and
- Shortened Option (Retaining Structure) – 2 zones, 8 nodes and 7 links.

6.4 The QUADRO Model

6.4.1 Overview

The QUADRO models were developed to examine the road user delays and works costs associated with the construction of the improvement options. Traffic management proposals and associated programming information have been developed to allow a comparative assessment of the options under consideration. It is recognised that, with further development of the works and consultations regarding the proposals and traffic management arrangements, further refinements are possible.

6.4.2 Traffic Management Effects

The effects of traffic management measures needed to allow safe construction include:

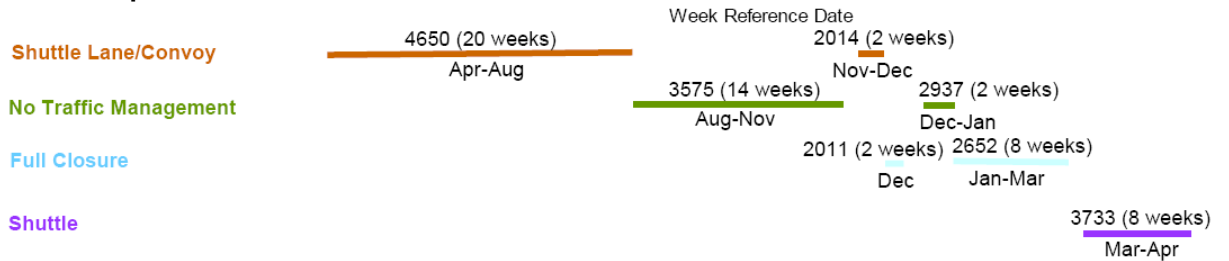
- Shuttle working;
- Shuttle working with traffic signals/ manual control;
- Full closure of the road; and
- The length of the diversion (from Tyndrum to Tarbet) of 83 Km.

These factors were considered for each option, together with the relevant construction period and the adjusted AADT traffic flows with appropriate seasonality factor.

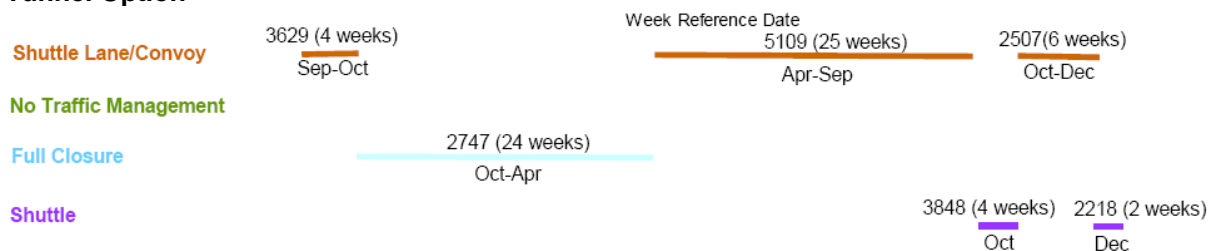


The assumed traffic management programme for each option is summarised below:

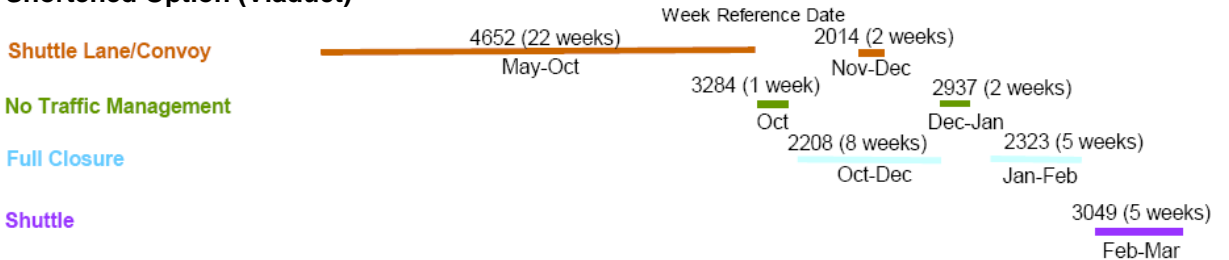
Viaduct Option



Tunnel Option



Shortened Option (Viaduct)



Shortened Retaining Wall



The following lengths were adopted in the QUADRO assessment for each of the four improvement options:

- Main Route Length 33.1km (from Tarbet to Tyndrum);
- Primary Approach Length, northbound 10.5km (from Tarbet to Pulpit Rock);
- Secondary Approach Length, southbound 22.2km (from Tyndrum to Pulpit Rock);
- Length of Traffic Management 0.4km (at Pulpit Rock); and
- Diversion Length 83km.

6.5 Operational Appraisal

6.5.1 Journey Times

Although NESA, which is primarily a link-based model, reports journey times along predefined routes in the modelled network, this information excludes junction delays, which are normally an important consideration when comparing the overall changes in journey time.

To provide a direct comparison between journey times in the Do-Minimum and Do-Something networks the average vehicle speeds for each link and the corresponding junction delays along the A82 at Pulpit Rock were extracted from the NESA models.

6.5.2 Network Capacity

Examination of the model results indicates that the network currently operates and will continue to operate within capacity over the assessment period to 2027.

6.5.3 Road Safety

The changes in the number of total personal injury accidents over the 60-year assessment period due to the provision of the proposed improvements are shown in Tables 6.7 to 6.10 in the TEAR.

Based on the application of national accident values the proposed improvement options would deliver benefits in road safety as below:

- Tunnel Option 6.4 less
- Viaduct Option 5.3 less
- Shortened Option (Viaduct) 4.6 less
- Shortened Option (Retaining Structure) 4.6 less

6.6 Economic Appraisal

6.6.1 Cost Estimate

Detailed cost estimates (as provided in Section 3.6 of this report) used as the basis of the economic appraisal, based on Q4 2008 prices, excluding VAT and including allowance for optimism bias are summarised in Table 6.1 below

Item	Viaduct Option	Tunnel Option	Shortened Option (Viaduct)	Shortened Option (Retaining Structure)
Improvements Cost (£m)	8.2	8.7	6.6	6.3
Optimism Bias (£m)	2.0	2.2	1.6	1.5
Total Cost (£m)	10.2	10.9	8.2	7.8

Table 6.1: Summary of Improvement Costs

6.6.2 NESAs Appraisal

The following table summarises the results of the NESAs evaluation.

Item	Viaduct Option	Tunnel Option	Shortened Option (Viaduct)	Shortened Option (Retaining Structure)
Present Value of Benefits (£m)	2.53	3.68	2.71	2.68
Present value of Costs (£m)	7.50	8.03	6.00	5.75
Net Present value (£m)	-4.97	-4.34	-3.29	-3.06
Benefit to Cost Ratio	0.34	0.46	0.45	0.47

Note 1: Assessment is based on NRTF Central Growth with results expressed in 2002 prices

Table 6.2: Summary of NESAs evaluation

6.6.3 QUADRO Appraisal

The following table summarises the results of the QUADRO evaluation.

Item	Viaduct Option	Tunnel Option	Shortened Option (Viaduct)	Shortened Option (Retaining Structure)
Present Value of Benefits (£m)	-2.879	-6.770	-3.268	-4.672
Present value of Cost (£m)	-0.092	-0.223	-0.106	-0.154
Net Present Value (£m)	-2.787	-6.547	-3.162	-4.518

Note 1: Assessment is based on NRTF Central Growth with results expressed in 2002 prices

Table 6.3: Summary of QUADRO evaluation

6.6.4 Combined NESAs/QUADRO Appraisal

The following table summarises the results of the combined NESAs/QUADRO evaluations.

Item	Viaduct Option	Tunnel Option	Shortened Option (Viaduct)	Shortened Option (Retaining Structure)
Present Value of Benefits (£m)	-0.349	-3.090	-0.558	-1.992
Present value of Cost (£m)	7.408	7.807	5.894	5.596
Net Present Value (£m)	-7.757	-10.897	-6.452	-7.588
Benefit to Cost Ratio	-0.047	-0.396	-0.095	-0.356

Note 1: Assessment is based on NRTF Central Growth with results expressed in 2002 prices

Table 6.4: Summary of NESAs & QUADRO evaluations

6.7 Summary

The results from the combined NESA and QUADRO appraisal indicate that the four improvement options would all deliver a negative Net Present Value.

In descending order of Net Present Values under central traffic growth, the options are listed as follows :

- **Shortened Option (Viaduct):** for investment cost of £5.894m (2002 prices) the Net Present value is -£6.452m;
- **Shortened Option (Retaining Structure):** for investment cost of £5.596m (2002 prices) the Net Present value is -£7.588m;
- **Viaduct Option:** for investment cost of £7.408m (2002 prices) the Net Present value is -£7.757m; and
- **Tunnel Option:** for investment cost of £7.807m (2002 prices) the Net Present value is -£10.897m.

7.0 Scheme Assessment Summary

7.1 Summary

On completion of the Stage 2 assessment no one option emerged as being preferred in all categories considered. Listed below are the arguments for and against each option. Table 7.1 summarises the main findings of the options assessment reported in the previous chapters.

7.1.1 Viaduct

For

- Works generally offline
- Shortest period of full road closures
- Appearance developed in line with the aspirations of the LLTNPA
- Lowest rating from risk workshop

Against

- Viaduct assessed unfavourably in terms of visual impacts
- Requires works along the shoreline of the loch and over the water
- High capital cost

7.1.2 Tunnel

For

- Preferred in terms of least damage to the shoreline of the loch and environmental habitats.
- Works over water minimised.
- Generally out of sight and therefore considered to pose least visual impact
- Provides the biggest improvement in terms of road alignment

Against

- Most expensive
- Worst economics
- Longest construction period and requires longest period of full road closures
- Approach road has greatest impact on the setting of Pulpit Rock scheduled monument.
- Uncertainty regarding the extent of lighting and associated impacts.
- Poses risk of disruption to the west highland line rail services.
- Highest risk of traffic closure overruns

7.1.3 Shortened option (viaduct)

For

- Best economics
- Section of works offline
- Less expensive than the full viaduct option
- Viaduct section appearance developed in line with the aspirations of the LLTNPA

Against

- Viaduct section assessed unfavourably in terms of visual impacts
- Requires works along the shoreline of the loch and over the water
- Requires section of rock cut which may not be acceptable to stakeholders particularly LLTNPA.

7.1.4 Shortened option (retaining structure)

For

- Least expensive of the four options considered

Against

- Retaining wall section assessed unfavourably in terms of visual impacts
- Requires works along the shoreline of the loch and adjacent to the water
- Requires section of rock cut which may not be acceptable to stakeholders particularly LLTNPA.
- Appearance of retaining wall element may not be acceptable to stakeholders particularly LLTNPA
- Potentially adverse maintenance issues
- Highest rating from risk workshop.

	Viaduct	Tunnel	Shortened (Viaduct)	Shortened (Retaining Structure)
Environmental (landscape & visual)	Although the viaduct option has been developed in line with LLTNPA aspirations it is considered to have the greatest landscape and visual impacts.	Considered to offer the least landscape and visual impacts. Lighting, if determined as required on approaches, is considered detrimental.	The Shortened Viaduct option would also create a prominent new feature in the landscape but it would be considered less intrusive than the Viaduct option because it does not go all the way round the rock outcrop.	Although the Shortened Retaining Structure option would encroach into Loch Lomond it would be a less heavily engineered element than both the Viaduct options. There would still be a hard, unnatural edge to the loch but smaller in scale and generally less intrusive.
Environmental (nature conservation)	Associated works will be disruptive to shoreline and littoral habitats. Drainage outfalls will require a simple CAR licence application.	Considered the least harmful in terms of nature conservation as it generally avoids works along the shore line of the loch. Drainage outfall will require a simple CAR licence application.	Associated works will be disruptive to shoreline and littoral habitats. Drainage outfalls will require a simple CAR licence application.	Associated works will be disruptive to shoreline and littoral habitats. New structure provides little scope for new habitats to develop. Drainage outfalls will require a simple CAR licence application.
Capital cost	£11.7M (inc VAT) 2 nd most expensive	£12.5M (inc VAT) most expensive	£9.3M (inc VAT) 2 nd least expensive (marginal)	£8.9M (inc VAT) Least expensive
Economics (combined NES & QUADRO)	PVB -£0.349M PVC £7.408M NPV -£7.757M	PVB -£3.090M PVC £7.807M NPV -£10.897M Worst Economics	PVB -£0.558M PVC £5.894M NPV -£6.452M Best Economics	PVB -£1.992M PVC £5.596M NPV -£7.588M
Buildability	Duration of works 56 weeks. Full road closures required for 10 wks. Mainly built offline from floating platforms erected within the loch and as a result requires shortest period of full road closures during the construction stage.	Duration of works 65 weeks. Full road closures required for 24 wks Requires the longest period of full road closures due to works to construct the south and north portals and address the railway retaining wall at the south end.	Duration of works 43 weeks. Full road closures required for 13 wks Viaduct section built offline from floating platform erected within the loch. Full road closures will be required to form the Viaduct tie-ins and rock cutting works.	Duration of works 48 weeks. Full road closures required for 18 wks Retaining wall section built from floating platform erected within the loch. Road closures required during most of this operation and during the rock cutting works.
Maintenance	Regular routine inspection and maintenance required.	Regular routine inspection and maintenance required.	Regular routine inspection and maintenance required.	Depending on form of construction there could be some significant maintenance issues associated with the anchor heads used to hold the new wall in position particularly as these will partly be below water level.
Consultations	Developed in line with LLTNPA aspirations. No concerns raised by other stakeholders.	Preferred by LLTNPA and SEPA although also concern from LLTNPA and HS regarding the extent and impacts of lighting on the approaches. Encroaches into the setting of Pulpit Rock Scheduled Monument.	Developed in line with LLTNPA aspirations. No concerns raised by other stakeholders.	Least preferred by LLTNPA and SEPA.
Risk	Lowest risk factor @ 1.98 Works developed in line with LLTNPA aspirations.	Highest risk factor @ 2.82 Potential for difficult interface with Network Rail and there remains a risk of disrupting the Glasgow - Fort William Rail service as a result of the works to the retaining wall.	2 nd lowest risk factor @ 2.33	2 nd highest risk factor @ 2.65

Table 7.1 – Summary of Options Assessment

8.0 Conclusion and Recommendation

8.1 Conclusion

All Options achieve the main project objective of removing congestion at Pulpit Rock by realigning the A82 such that free flow of traffic is permitted without the use of the existing traffic signal controls.

In order to determine the Preferred Option, the four options have been assessed against eight different categories, as summarised in Table 7.1. This has demonstrated that no one option emerges as being preferred across all aspects. The assessment of the four options against each of the eight categories gives the following conclusions.

One of the scheme objectives is “to mitigate the environmental impact of the new works where possible”. In terms of environment impact, the assessment undertaken has concluded that the impact is broadly similar for all options for the majority of environmental topics. The two main areas where there are significant differences are landscape and visual impact, and ecology and nature conservation.

In relation to landscape and visual impact, it is clearly the case that the Tunnel option has the least impact although this is potentially diluted by the likelihood that approach lighting will be required. In contrast, the other three options all result in a visual impact, with the greater intrusion of the Viaduct option into the Loch resulting in it being assessed as having the greatest impact. Both the other two options also create a prominent new feature in the landscape but are assessed as being less intrusive than the Viaduct option. It should also be noted that in the past, and in contrast to our visual impact assessment, from a landscape perspective LLTNPA has expressed a strong preference for the Viaduct option.

Similarly, the Tunnel option has been assessed as being the least harmful in terms of nature conservation as it avoids work along the shoreline. The other three options all have an impact on nature conservation as the works will be disruptive to shore and littoral habitats. The impact is broadly similar for all three options.

A Traffic and Economic assessment consisting of a combined NESAs and QUADRO appraisal was carried out. The NESAs appraisal compared the cost and road user benefits of the proposed improvement options taking into account both transport economic efficiency and road safety issues. The QUADRO appraisal examined the road user delays and works cost associated with the construction of the improvement options and future maintenance requirements. Both appraisals consider effects over a 60 year period. The Traffic and Economics appraisal indicates that all four options offer a negative Net Present Value (NPV), with the Tunnel Option offering the worst economics and the Shortened Option (Viaduct) offering the best. The negative results are a function of the relatively high capital cost required to address the particularly difficult issues associated with the site coupled with moderate benefits being generated by the schemes.

Due to the physical characteristics of the site and the lack of a reasonable diversion route, **buildability** and hence the need for road closures has been identified as an important differentiator between options. Preliminary construction methods and programmes have indicated that the Tunnel option will result in the greatest length of full road closures due to the substantial works required in the vicinity of the South Portal. Of the other options, the requirement for a new rock cutting adjacent to the existing A82 carriageway means that both the Shortened options require significantly lengthier road closures than the Viaduct option.

The nature of the site and the proposed solutions also means that **maintenance** has been assessed as a potentially significant issue, especially with respect to the intrusion of some of the schemes into the Loch. Further consideration has suggested that three out of the four options will only require routine inspection and maintenance. The presence of anchor heads below water level, as required for the Shortened Option (Retaining Structure), does however present a potential future maintenance liability.

In June 2007 and June 2008, Value for Money Workshops were held to consider the options at various stages of the design. The workshops were attended by representatives from Transport Scotland, their consultant Scott Wilson and various stakeholders. The workshops were facilitated by an independent consultant having had no previous involvement in the project. **Consultations** with stakeholders and their attendance at the workshops have proven to be an important factor in the scheme development. With the exception of the LLTNPA and SEPA there have been no strong preferences expressed by stakeholders. Following on from the workshops separate meetings were held with the LLTNPA and SEPA. The LLTNPA favoured both the Viaduct Option and the Shortened Option (Viaduct) with their least favourite being the Shortened Option (Retaining Structure). SEPA's order of preference was the Tunnel Option because it does not impinge on the shoreline followed by the Shortened Option (Viaduct), Viaduct Option and Shortened Option (Retaining Structure).

The **capital cost** of the options varies, although it is noticeable that the spread of costs has narrowed as understanding of the site has evolved. The most expensive option is the Tunnel Option at £12.5million (including VAT) and the least expensive is the Shortened Option (Retaining Structure) at £8.9million (including VAT).

Due to the nature of the scheme, **risk** has also been identified as an important factor in considering the preferred solution. The risk workshop held during the Stage 2 Assessment identified the risk associated with each option. Efforts have been made to address risks as far as reasonably practical at this stage. The current position is that the Tunnel Option presents the highest risk and the Viaduct Option the lowest.

8.2 Recommendation

Consideration of the summary results and the above conclusions suggests that the biggest option differentiators and hence the main factors that should be considered in selecting a preferred option are buildability, cost and risk, albeit that these influence, or are influenced by, other categories.

A holistic assessment of the Tunnel option indicates that it should be discounted. Although it has been assessed as having the least environmental impact, it is not considered that the environmental advantages of the Tunnel option compared to other options outbalances the high capital cost and long road closures required. Whilst a tunnel would initially appear to be an attractive option, the difficulties encountered at the south portal, due to the proximity of the railway and the lack of working space, make this an expensive and high risk option.

The Shortened Option (Retaining Structure) option is estimated to have the lowest capital cost, however this is countered by negative findings in a number of other areas. The nature of this solution means that the construction requires lengthy full road closures and presents potential future maintenance liabilities. It also means that it has been assessed to be the riskiest of the non-tunnel options and it is considered that this and the lengthier road closures negate the lower capital cost.



The environmental impact of the two viaduct options is considered to be comparable. Buildability and risk are considered to be key factors when comparing the two viaduct options. The Shortened Option (Viaduct) has the lowest capital cost but a higher risk factor. Both viaduct options share risks in relation to the need to work in and from the loch. The Viaduct Option has been assessed as requiring four weeks less full closures than the Shortened Option (Viaduct). The additional four weeks closure can be balanced against the lower capital cost. Considering the closures in relation to capital costs, the Shortened Option (Viaduct) offers better value for money than the additional £2.4m capital cost of the Viaduct Option. The economics data also demonstrates the Shortened Option (Viaduct) having better economics.

Therefore it is considered that the lower capital cost and better economics associated with the Shortened Option (Viaduct) outweigh the Viaduct Option's shorter road closures and lower risk factor.

It is recommended that the Shortened Option (Viaduct) should be taken forward for further development and full Stage 3 Scheme Assessment.

9.0 References

9.1 Design Manual for Roads and Bridges

TD 9/93	Highway Link Design
TD27/05	Cross-Sections and Headrooms
TD 37/93	Scheme Assessment Reporting
Volume 5	Assessment and Preparation of Road Schemes
Volume 11	Environmental Assessment
Volume 15	NESA Manual

9.2 Scott Wilson Documents

A82 Tarbet to Fort William	Route Action Plan Study
S100785/SW/REP/H002	Inception Report
S100785/SW/REP/H003	STAG Review Report
S100785/SW/REP/H012	Risk Workshop Report
S100785/SW/REP/G002	Preliminary Sources Study Report
S100785/SW/REP/T002	Traffic Survey and Data Report
S100785/SW/REP/T003	Local Model Validation Report
S100785/SW/REP/T004	Comparative Economic Appraisal of Improvement Options Report
S100785/INC/040	Inception Workshop Report
S100785/INC/061	Options Workshop Report

9.3 Local Authorities Documents

The Argyll and Bute Structure Plan 2002 (Approved November 2002);

Argyll & Bute LBAP <http://www.argyll-bute.gov.uk/biodiversity/LBAP/Index.htm>

The Dumbarton District, District Wide Local Plan;

Loch Lomond and the Trossachs National Park Plan 2007-2012 (Adopted March 2007);

Loch Lomond and Trossachs National Park Plan:

<http://www.lochlomond-trossachs.org/park/default.asp?p=296>

9.4 Other Publications

Forestry Commission Land Information Search website:

<http://fortingall.forestry.gov.uk/glade/ccheck/ConstraintsChecker.htm?map=scotland&l=e&c=e&controls=labels%3atru>

Guidelines for Landscape and Visual Assessment, Second Edition, The Landscape Institute/Institute of Environmental Management and Assessment (Spon Press 2002) (GLVIA).

HM Treasury's New Green Book on Appraisal and Evaluation in Central Government – CHE Memorandum 121/03



IEEM (2006) Guidance on Ecological Impact Assessment.

Interim Supplementary Guidance to the DMRB Volume 11 on Landscape and Visual Assessment issued by The Scottish Executive (11/02/02)

JNCC / BTO Birds of Conservation Concern (2002) <http://www.bto.org/psob/index.htm>

National Planning policy Guideline (NPPG) 14 Natural Heritage;

National Biodiversity Network Gateway: <http://www.searchnbn.net>

The Scottish Executive, 'Cost Effective Landscape: Learning from Nature

Scottish Biodiversity List:

<http://www.biodiversityscotland.gov.uk/pageType2.php?id=35&type=2&navID=92>

SNH Sitelink website:

http://gateway.snh.gov.uk/portal/page?_pageid=53,910284,53_920284&_dad=portal&_schema=PORTAL

Strachan R (1998) Water Vole Conservation Handbook.

UK Biodiversity Action Plan: www.ukbap.org.uk

9.5 Legislation

Conservation (Natural Habitats &c.) Regulations 1994

EC Habitats Directive

Nature Conservation (Scotland) Act 2004

WCA, 1981

Protection of Badgers Act 1992

Appendix A – List of Environmental Consultees

Statutory and Non-Statutory Consultations were made with the following bodies:

Statutory Consultations

- Historic Scotland;
- Loch Lomond and the Trossachs National Park Authority (LLTNPA);
- Scottish Natural Heritage Area Officer;
- Scottish Environment Protection Agency (SEPA); and
- Loch Lomond Fisheries Trust (LLFT).

Non-Statutory Consultations

- Scottish Badgers;
- West of Scotland Archaeology Service;
- SUSTRANS Scotland
- Scottish Rights and Access of Way Society
- The British Horse Society Scotland
- Cyclists' Touring Club (CTC) Scotland
- Ramblers Association Scotland
- Rapsons
- Scottish Council Development and Industry
- Loch Lomond Tourist Board
- Friends of Loch Lomond
- Argyll and Bute Council



Appendix A1 – Cultural heritage sites identified within the study area

ID	Name	NMRS	SMR	NGR	Status	Class	Description
1	Pulpit Rock, preaching site, south of Ardlui	NN31SW 15	21833	NN 3262 1362	SM No 10972	Preaching Site	<p>Historical records suggest that The rock was first used for preaching in 1825 after locals, mainly shepherds, in the northern part of Arrochar parish complained to the Rev Peter Proudfoot, their minister, about the eight-mile walk to and from their Sabbath devotions. If they built him a vestry and a pulpit, replied Mr Proudfoot, he would come and preach to them.</p> <p>With money from two local worthies, Watson of Glenfalloch House and Grieve of Keilatur, the local men quarried out a 10ft-high hole in the face of the rock. It was large enough to house the minister, an elder and the precentor who led the singing. Explosives were used, and a man called Robert MacFarlane was blinded by the blast.</p> <p>A wooden platform with a pulpit was bolted to the rockface and a door was actually fitted to the hole in the rock, a metal hinge of which is still there. Services were held during the summer months for 75 years, until a mission church was established at Ardlui in 1895. At some point, the wooden door and pulpit platform were used by tinkers for fuel. (Freeman J)</p> <p>There appears to be no evidence to suggest that this site has any associations with earlier religious observances.</p>
2	Island I Vow, Castle and Settlement, Loch Lomond	NN31SW 2	1834	NN 3313 273	SM No 11073	Castle	The castle was built in 1577 by Andrew MacFarlane. The castle stands at the southern edge of the island with a small bay immediately to the south. The bay is now filled with fallen masonry but a retaining wall can be seen on its western edge. In 1581 the dowager of the MacFarlane chief had a life rent on the castle from her son. The castle was occupied by the MacFarlanes as their principal residence after their castle on Inveruglas Isle was destroyed by Cromwell's troops in the mid 17th century. The MacFarlanes moved to a new house at Arrochar in 1697 and the castle was thereafter used as a storehouse.
3	Island I Vow, Castle	NN31SW 2	1834	NN 3313 1273	B Listed HBN No 821	Castle	As above
4	Tarbet – Crianlarich Military Road		12425	NJ 2715 6126		Transport	Remains of Major Caulfeild's Military Road from Tarbet – Crianlarich. Much of the route of this road has been destroyed by the construction of the railway and the modern road.

Appendix A2 – Ecological Baseline Conditions and Relevant Legislation

Statutory Designated Sites

Ben Vorlich Site of Special Scientific Interest (SSSI) is located within 1km to the west of the A82 at its nearest point. It is of biological interest regarding its upland habitat, being the highest hill (at 943m height) in the District of Argyll & Bute. Its notable habitats include good rock ledge, flush and wet heath communities. Local plant species and a range of upland birds, mammals and invertebrates provide additional interest. Its notified features are: Alpine flush (upland fen marsh and swamp), subalpine wet heath (upland dwarf shrub heath) and tall herb ledge (inland rock).

Pollochro Woods SSSI is located on the opposite shore of the Loch on steep westerly facing slopes. It is an extensive area of semi-natural woodland, most of which is classified as ancient. The site supports the largest extent of slope Alderwood in the Central Region. Slope Alderwood is characteristic of the Western Highlands with a canopy dominated by alder (*Alnus glutinosa*), oak (*Quercus* sp.), birch (*Betula* sp.) and ash (*Fraxinus excelsior*) with an understory of hazel (*Corylus avellana*), hawthorn (*Crataegus monogyna*) and holly (*Ilex aquifolium*). The woods have an exceptionally rich ground flora and many subsidiary habitats such as glades, crags, streams and lochshore.

Non-Statutory Designated Sites

There are two areas of woodland classified as ancient semi-natural woodland on the SNH Ancient Woodland Inventory (AWI) – one approximately 450 metres north west of the Scheme Boundary at its nearest point, and the other approximately 420 metres to the east, on the opposite shore of the Loch. No other locally important or recreational sites are designated in proximity to the site.

Habitats

The main habitats within the study area are semi-natural broadleaved woodland, dense scrub, continuous bracken, unimproved grassland, marshy grassland, natural rock exposures and a stretch of the north western shores of Loch Lomond.

Semi-natural Broadleaved Woodland

Mature semi-natural broadleaved woodland dominated by downy birch (*Betula pubescens*), alder and oak with ash more frequent towards the south of the survey area, is present throughout the length of the study area to the west of the A82, to the west of the railway line and to the east of the A82 between the road and the Loch. The woodland varies in character throughout but generally contains species such as common bent (*Agrostis capillaris*), sweet vernal grass (*Anthoxanthum odoratum*), scattered rowan (*Sorbus aucuparia*) and hazel saplings and scattered bramble (*Rubus fruticosus*) and bracken (*Pteridium aquilinum*), with flushed parts comprising blunt-leaved bog moss (*Sphagnum palustre*) beneath a layer of bulbous rush (*Juncus bulbosus*), marsh violet (*Viola palustris*), marsh bedstraw (*Galium palustre*) and lesser spearwort (*Ranunculus flammula*). The ground flora is heavily grazed to the north, but elsewhere generally a mix of bilberry (*Vaccinium myrtillus*), honeysuckle (*Lonicera periclymenum*) and ling (*Calluna vulgaris*) and where the canopy is open or sparse, bracken dominates.

An area of less acidic semi-natural broadleaved woodland towards the south of the survey area comprises tall herbs including wild angelica (*Angelica sylvestris*), meadowsweet (*Filipendula ulmaria*), creeping buttercup (*Ranunculus repens*), herb Robert (*Geranium robertianum*) and ferns such as male fern (*Dryopteris filix-mas*) and lady fern (*Athyrium filix-femina*). Within the railway boundary to the west of Pulpit Rock is an area of wet ground offering the greatest floristic diversity, with herbs including marsh violet, creeping buttercup and common sorrel (*Rumex acetosa*) with occasional golden saxifrage (*Chrysosplenium oppositifolium*), yellow pimpernel (*Lysimachia nemorum*) and bluebell (*Hyacinthoides non-scripta*).

Just to the north of Pulpit Rock is an area of flushed ground with many large boulders. These boulders support a diverse range of bryophytes, some of which are uncommon or rare; including slender mouse-tail moss, (*Isothecium myosuroides*), common tamarisk moss (*Thuidium tamariscinum*), little shaggy-moss (*Rhytidiadelphus loreus*), greater whipwort (*Bazzania trilobata*), lesser whipwort (*Bazzania tricrenata*), earworts (*Scapania* sp.), and ostrich-plume feather-moss (*Ptilium crista-castrensis*). In this area at NN 32413.13695 a small collection of boulders support a large assemblage of the rare oceanic liverwort, western featherwort (*Plagiochila atlantica*). This liverwort is also found to the south of the survey area on a small rock face. The small ferns, Wilson's filmy fern (*Hymenophyllum wilsonii*) and Tunbridge filmy fern (*H.tunbrigense*) can also be found on suitable rock faces close to Pulpit Rock and at the aforementioned rock face to the south. Rich bryophyte assemblages can be found throughout the study area within small rock exposures, tree boles and hollows.

The area to the west of the railway embankment has a variety of habitats; to the north the broadleaved woodland becomes sparse with the northern extremities being a mosaic of bracken and grassy patches with a few scattered trees. To the south of this area the canopy is open, with the ground flora dominated by bracken. There is an area of marshy grassland to the south, dominated by purple moor-grass (*Molinia caerulea*) with occasional *S.palustre*, marsh violet, and bog myrtle (*Myrica gale*) and a few patches of unimproved acid grassland on sloping areas.

Rock Exposures

The top of Pulpit Rock itself is covered with ericaceous vegetation – mainly ling. The sides (except the exposed north east face) have a good covering of bryophytes including western earwort (*Scapania gracilis*) and Scott's fork-moss (*Dicranum scottianum*) with overleaf peltia (*Pellia epiphylla*) being found on the wet ground around the base. The inland cliff exposure to the west of the section of the A82 under traffic light control supports little vegetation except for a few ericoids such as bell heather (*Erica cinerea*) and ling. The lower parts of the cliff support common bryophytes and a few vascular plants such as common butterwort (*Pinguicula vulgaris*), male fern, broad buckler fern (*D.dilatata*) and goldenrod (*Solidago virgaurea*).

Scrub, Unimproved Grassland and Marshy Grassland

Within the central part of the area most likely to be impacted by the Scheme is a small area of scrub comprising a complex of bramble, bracken and scattered young alder and hazel. Close by is a region of unimproved acid grassland dominated by common bent, sweet vernal grass, heath bedstraw (*Galium saxatile*) and tormentil (*Potentilla erecta*). The bryophyte layer includes abundant *Rhytidiadelphus squarrosus*.

The area surrounding Pulpit Rock also includes a few areas of marshy grassland dominated by sharp-flowered rush (*Juncus acutiflorus*), bulbous rush and small carices such as carnation sedge (*Carex panacea*), yellow sedge (*C.viridula*) with occasional star sedge (*C.echinata*) and glaucous sedge (*C.flacca*). The herb assemblage generally includes tormentil, marsh violet and yellow pimpernel with a moss layer of principally *Sphagnum auriculatum*. A marshy area just to the south supports a more

diverse herb assemblage with *S.palustre*, creeping buttercup, lesser spearwort, marsh willowherb (*Epilobium palustre*), greater birdsfoot trefoil (*Lotus pedunculatus*) and bog pondweed (*Potamogeton polygonifolius*). A similar area of marshy grassland exists to the west of the railway line towards the south of the study area.

Invasive Species

There are two stands of Japanese knotweed (*Fallopia japonica*) within the survey corridor. One stand of c.5m length is within the strip of woodland between the Loch and the A82 roadside just to the east of Pulpit Rock (Grid Reference: NN 32583.13674). The other smaller stand is located c.100m from the southern extent of the survey area (Grid Reference: NN 32885.13305).

North Western Shores of Loch Lomond and Aquatic Macrophyte Surveys

Aquatic macrophyte surveys were carried out in September 2007. These surveys were deemed appropriate in consultation with SNH. The survey was carried out along the shoreline of Loch Lomond in 8 discreet sections, from south (Grid Reference: NN32928.13252) to north (Grid Reference: NN32428.13749). The majority of the shoreline is cobble / boulder substrate, some bedrock outcrops and matrices of gravel and pebble. Two specific locations had sand and silt substrate, which were identified at the time of survey to be potentially important habitats for lamprey larvae.

In terms of the aquatic macrophyte resource, the assemblage was typified by the following species: shoreweed (*Littorella uniflora*), water lobelia (*Lobelia dortmanna*), lake quillwort (*Isoetes lacustris*), reed canary-grass (*Phalaris arundinacea*), bulbous rush (*Juncus bulbosus*), the moss species *Fontinalis antipyretica*, water spearwort (*Ranunculus flammula*), the stonewort *Callitriche hermaphroditica* (washed up on shore) and alternate flowered milfoil (*Myriophyllum alterniflorum*).

Protected Species

Badger (*Meles meles*)

The badger is protected under Schedule 6 of the Wildlife and Countryside Act 1981 (as amended) (WCA) and is also the subject of specific legislation, namely the Protection of Badgers Act 1992. Under the Act, it is an offence to (or attempt to) kill, take, injure or disturb a badger or its sett (shelter). This includes the obstruction of access to a sett.

Badger surveys were conducted on 7th June 2007. No signs of badger activity (e.g. hairs, latrines or foraging marks) or setts were found. The area is suitable for setts, being wooded with plenty of cover, but a lack of open cultivated land nearby limits the habitat suitability in terms of foraging area. This limitation stands for the wider area also rendering it likely that setts will not be present until at least Inveruglas to the south.

As a result of no badger signs being found during the surveys, potential impacts upon this species are not considered within the options assessment, it being limited to those impacts readily identified during survey visits.

Red Squirrel (*Sciurus vulgaris*)

The red squirrel is protected by its inclusion on Schedules 5 and 6 of the WCA, under which it is an offence to intentionally kill, injure or take any red squirrel, damage, destroy, or obstruct access to any structure or place used by a red squirrel for shelter or protection or to disturb a red squirrel while it is

occupying a structure or place used for shelter or protection. The red squirrel is listed as priority species in the UK Biodiversity Action Plan (UKBAP) and the Argyll & Bute LBAP.

The survey area is dominated by broadleaved woodland – a sub-optimal habitat for red squirrels and well separated from significant areas of coniferous plantation. Nonetheless red squirrels can survive well in broadleaved woodland, especially those with plentiful hazel nut supply, where their population densities are similar to those found in pure conifer woodland.

Red squirrel surveys were conducted on 7th June 2007 and will be continually updated to check for recent use of habitat during site visits throughout the Scheme Assessment period. No dreys or sightings were observed, however a caveat is that the survey was undertaken at what is regarded as an unsuitable time for sightings, 9am - 1pm.

As a result of no red squirrel signs being found during the surveys, potential impacts upon this species are not considered within the options assessment, it being limited to those impacts readily identified during survey visits.

Otters (*Lutra lutra*)

The otter is listed on Schedule 5 and 6 of the WCA. Under the provisions of this Act it is a criminal offence in most circumstances to intentionally kill, take or injure an otter; intentionally disturb an otter in its place of shelter; intentionally damage, destroy or obstruct access to a place of shelter. The EC Habitats Directive implemented through the Conservation (Natural Habitats &c.) Regulations 1994 (CNH) makes provision to protect both otters and their habitat. The otter is also listed as priority species in the UKBAP.

Otter surveys were conducted on the 19th April 2007, 7th June 2007 and 7th May 2008 and will be continually updated to check for recent use of habitat during site visits throughout the Scheme Assessment period.

Suitable otter habitat exists along the full stretch of the site in the form of the well-vegetated Loch side. There is a small burn that enters the Loch to the north of the northern traffic lights. During survey visits several otter spraints were found along the Loch side.

A sprainting site was found close to the northern limits of the ecological survey area beneath a drooping alder tree, this was a fresh sprainting site at the time of survey, with all spraints suspected within the last week. Further sprainting sites were immediately adjacent to the northern traffic lights, and directly beneath the southern traffic lights. The latter site is a suspected otter lying up site, with several cavities in the rocky embankment shelving into the Loch being big enough to allow otters to rest in. Otter spraints, both fresh and old, were found outside one of these cavities on more than one survey visit.

A heavily sprainted site was found to the south of the southern traffic lights, close to the shoreline beneath a mature ash tree – approximately fifteen spraints were found here.

Given the known otter presence, further otter surveys will be carried out by a qualified ecologist throughout the Scheme assessment period to ensure that construction activity immediately adjacent to the shoreline does not breach the legislation. With regard to the area identified as a likely otter shelter, licensing procedures must apply.

Water Vole (*Arvicola terrestris*)

Since 1998, the water vole has received limited legal protection in Scotland through its inclusion on Schedule 5 of the WCA, in respect of Section 9(4) only (Strachan, 1998). This section of the Act protects the water vole's places of shelter or protection, but does not protect the voles themselves. At the current time a recent alteration to legislation south of the border has afforded water voles full protection and there are proposals for such protection to be afforded to the water vole in Scotland in the near future. Legal protection makes it an offence to intentionally or recklessly damage or destroy or obstruct access to any structure or place that water voles use for shelter or protection or disturb water voles while they are using such a place. There is no provision for licensing the intentional destruction of water vole burrows for development or maintenance operations. The water vole is listed as priority species in the UKBAP.

Water vole surveys were conducted on the 7th June 2007. There are no suitable watercourses within the Scheme Boundary and no signs of water vole activity were found.

As a result of no water vole signs being found during the surveys, potential impacts upon this species are not considered within the options assessment, it being limited to those impacts readily identified during survey visits.

Wild Cat (*Felis sylvestris*)

The wildcat is protected by its inclusion in Schedules 5 and 6 of the WCA, under which it is an offence to intentionally kill, take or injure a wildcat; intentionally disturb a wildcat in its place of shelter; or intentionally damage, destroy or obstruct access to a place of shelter. The EC Habitats Directive implemented through the Conservation (Natural Habitats &c.) Regulations 1994 (CNH) makes provision to protect both wildcats and their habitat. The wildcat is a priority species on the Argyll & Bute LBAP and the UKBAP.

No signs of wildcat activity were found during the protected species surveys conducted on 7th June 2007. Upslope, to the west of the railway there is suitable habitat and shelter areas of craggy hills/slopes with a number of rocks/cavities that could possibly provide dens. However, there is unlikely to be sufficient suitable prey (e.g. rabbits, voles and mice). If construction activity remains to the east of the railway, then wildcat presence is unlikely to be impacted. No possible droppings were observed. A check of the NBN Gateway website yielded no records within 2km of the Scheme Boundary.

As a result of no wildcat signs being found during the surveys, potential impacts upon this species are not considered within the options assessment, it being limited to those impacts readily identified during survey visits.

Bats

All British bat species are listed on Schedules 5 and 6 of the WCA, and are also covered by the CNH Regulations. It is an offence to intentionally or deliberately kill, injure or capture (take) a bat; deliberately disturb a bat (whether in a roost or not); and damage, destroy or obstruct access to a bat roost. For the purposes of bat protection, a bat roost is defined as 'any structure or place, which is used for shelter or protection', regardless of whether it is in use or not. The common pipistrelle (*Pipistrellus pipistrellus*) bat and the soprano pipistrelle (*Pipistrellus pygmaeus*) are also listed as priority species in the UKBAP.

Bats can roost in buildings, bridges and mature trees with suitable cracks and crevices, and will use woodland edges and streams and waterbody shorelines as foraging habitat. There is an abundance of foraging habitat within the study boundary and it is therefore possible that bat species forage along many of the watercourses within the route corridor.

A number of suitable mature trees were observed within the Scheme boundary during protected species surveys in June and September 2007. Several areas have bat roost potential; between the northern traffic lights and the northern end of the survey area there are 2-3 mature alders with a mix of split limbs, rot holes, loose bark and crevices; several mature oaks throughout the site (e.g. the area between the traffic lights, to the south of the traffic lights, and to the immediate north of the traffic lights) are showing similar roost potential signs; a mix of silver birch, oak and ash to the west of the road may also serve as foraging habitat; and far to the south of the survey area is a very mature alder developing rot holes and broken boughs. These tree areas could serve as either roost sites or foraging areas for bats. Dawn re-entry surveys were conducted in September 2007 focusing around trees with bat roost potential, as identified above. No bats were observed emerging from or entering trees but several passes were detected, suggesting the Scheme corridor is used as foraging habitat for bats. Species noted during surveys were common pipistrelle and soprano pipistrelle.

Therefore there may be implications for impacts upon roosting bats. Further emergence surveys and roost potential assessments will be conducted as the Scheme assessment period continues to confirm whether any trees are being used by bats. During construction works it may be necessary for a trained ecologist to be present on site to oversee the removal of trees with bat roost potential to ensure no bats are harmed.

Breeding Birds

Breeding birds are protected by the WCA and the Nature Conservation (Scotland) Act 2004, whereby it is illegal to intentionally or recklessly kill, injure or take any wild bird, damage or destroy or otherwise interfere with the nest of any wild bird, and take or destroy an egg of any wild bird. Therefore, between March and August it is an offence to remove or destroy a bird nest, and any tree or scrub removal should be undertaken outside of these months. If clearance work has to be undertaken during the breeding bird season, an ornithological expert would have to be present, to ensure that no active nests were disturbed. In addition, birds listed on Schedule 1 of the WCA are protected against intentional or reckless disturbance on or near an active nest. Schedule 1 status also infers a right of arrest by a police officer if someone is suspected of committing certain offences against one of these species.

Three breeding bird survey visits (CBC) were carried out between April and June 2007 in order to identify and locate breeding bird species within 100m of the route corridor. A list of species recorded is included as Table a1. The species recorded included common woodland species, and species such as grey wagtail (*Motacilla cinerea*), mistle thrush (*Turdus viscivorus*), song thrush (*Turdus philomelos*), redpoll (*Carduelis cabaret*), tree pipit (*Anthus trivialis*), wood warbler (*Phylloscopus sibilatrix*) and willow warbler (*Phylloscopus trochilus*). Of particular note were five bullfinch (*Pyrrhula pyrrhula*), and six spotted flycatcher (*Muscicapa striata*).

Two of these bird species are listed in the UKBAP (redpoll and tree pipit) and the song thrush is listed on the Argyll & Bute LBAP. Three species found on site are listed as Red Status (high conservation concern) on the JNCC / BTO Birds of Conservation Concern list (BoCC). These species are bullfinch, song thrush and spotted flycatcher (*Muscicapa striata*). Any removal of habitat along the alignment may involve breeding bird habitat, thereby reducing the capacity of the area to harbour breeding birds. It is important that any removal of this habitat is programmed accordingly, to avoid the breeding bird season.

Table a1 – Species recorded during breeding bird surveys

Type of Bird	Number of individuals recorded	Number displaying breeding behaviour	Conservation Status (BoCC)
Blackcap <i>Sylvia atricapilla</i>	6	3	Green Status
Blue tit <i>Parus caeruleus</i>	34	3	Green Status
Bullfinch <i>Pyrrhula pyrrhula</i>	5	0	Red Status
Chaffinch <i>Fringilla coelebs</i>	43	19	Green Status
Coal tit <i>Parus ater</i>	3	0	Green Status
Dunnock <i>Prunella modularis</i>	4	0	Green Status
Garden warbler <i>Sylvia borin</i>	7	4	Green Status
Great spotted woodpecker <i>Dendrocopos major</i>	3	0	Green Status
Great tit <i>Parus major</i>	23	1	Green Status
Grey wagtail <i>Motacilla cinerea</i>	3	0	Amber Status
Long-tailed tit <i>Aegithalos caudatus</i>	22	1	Green Status
Mistle thrush <i>Turdus viscivorus</i>	1	0	Amber Status
Pied wagtail <i>Motacilla alba</i>	4	0	Green Status
Redpoll <i>Carduelis cabaret</i>	9	0	Amber Status UK BAP
Robin <i>Erithacus rubecula</i>	45	21	Green Status
Siskin <i>Carduelis spinus</i>	22	4	Green Status
Song thrush <i>Turdus philomelos</i>	5	4	Red Status Argyll & Bute LBAP
Spotted flycatcher <i>Muscicapa striata</i>	6	2	9.5.1.1.1.1.1.1.1 Red Status
Tree pipit <i>Anthus trivialis</i>	1	1	9.5.1.1.1.1.1.1.1 Amber Status UK BAP
Treecreeper <i>Certhia familiaris</i>	11	0	Green Status
Willow warbler <i>Phylloscopus trochilus</i>	37	35	Amber Status
Wood warbler <i>Phylloscopus sibilatrix</i>	6	1	Amber Status
Wood pigeon <i>Columba palumbus</i>	2	0	Green Status
Wren <i>Troglodytes troglodytes</i>	43	33	Green Status

Amphibians

Six species of amphibian are present in Scotland: the great crested newt (*Triturus cristatus*); smooth newt (*Triturus vulgaris*); palmate newt (*Triturus helveticus*); common toad (*Bufo bufo*); natterjack toad (*Bufo calamita*) and common frog (*Rana temporaria*). The great crested newt and natterjack toad are fully protected under the CNH Regulations and the WCA. The remaining four species receive limited protection. The great crested newt is a priority species on the UKBAP and the Argyll & Bute LBAP.

Aside from the Loch itself there are no standing waterbodies within the survey corridor. The section of Loch shoreline adjacent to the Scheme is steeply shelving, with little or no possibility of amphibian access/exit routes. There are many species of fish that would eat the amphibian larvae also, rendering the Loch an unsuitable amphibian habitat.

A check of the NBN Gateway website yielded one record of great crested newt c.2km to the south of the Scheme boundary on the opposite shore of the Loch.

As a result of no amphibian signs being found during the surveys, potential impacts upon these species are not considered within the options assessment, it being limited to those impacts readily identified during survey visits.

Reptiles

Four species of reptile are present in Scotland; adder (*Vipera berus*), common lizard (*Lacerta vivipara*), slow worm (*Anguis fragilis*) and grass snake (*Natrix natrix*), with the latter only rarely being reported in Scotland. All four species are afforded protection under the WCA, and strengthened by the Nature Conservation (Scotland) Act 2004. All four are listed on the UKBAP.

There is little suitable habitat for reptiles within and surrounding the survey corridor, being mostly tree cover with few potential basking sites. A check of the NBN Gateway website yielded one record of common lizard c.2km to the south of the Scheme boundary on the opposite shore of the Loch.

As a result of no reptile signs being found during the surveys, potential impacts upon these species are not considered within the options assessment, it being limited to those impacts readily identified during survey visits.

Fisheries

The key fisheries impacts were indicated by consultees to be concerned with powan (*Coregonus lavaretus*), Atlantic salmon (*Salmo salar*), and the three lamprey species, notwithstanding the importance of the fisheries resource as a whole.

The powan is protected under Schedule 5 of the WCA is a UKBAP priority species and is on the Argyll and Bute LBAP. The powan has a very restricted range, being found in Loch Lomond and Loch Eck, and now the Carron Reservoir and Loch Sloy. Powan spawn in late December to late February/early March. Spawning takes place in gravelly shallows off the shoreline, usually off headlands or on offshore reefs/banks. A scheme of this type could impact upon powan habitat directly, or cause pollution laden run-off to enter the waterbody.

The Atlantic salmon is listed on Annexes II and V of the Habitat's Directive, UKBAP, Argyll and Bute LBAP and the Scottish Biodiversity List. They migrate upstream to spawn between pool and riffle areas in substrate of cobble, pebble, and finer material. Spawning takes place during autumn/winter. In Loch Lomond, they are known to feed in the main Loch body - therefore a scheme of this type could impact upon Atlantic salmon through indirect impact upon spawning habitat, or pollution impacts.



The river lamprey (*Lampetra fluviatilis*), sea lamprey (*Petromyzon marinus*) and brook lamprey (*Lampetra planeri*) are all protected by the Habitats Directive and are on the Scottish Biodiversity List. The three species are known from Loch Lomond, and spawn upstream in tributaries which feed into the Loch. Larvae burrow into sandy/silty substrate down stream at river mouths, and may utilise marginal habitats within the lake shore itself.

From initial walkover surveys and consultation with SNH and the LLFT it was deemed appropriate that surveys should be carried out to collect adequate fisheries data to determine the location of habitats important to Atlantic salmon, whether lamprey or habitats important to lamprey are present in the affected areas, and in relation to powan. These surveys are currently being conducted (April – June 2008). However, there are initial results to indicate that confirmed powan spawning habitat is located 500m south of Pulpit Rock, off Rubha Ban point (Grid reference NN3300013250, Dr. Andrew Burrows, LLFT, by e-mail, June 2008).



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