Chapter 7: Spoil Management

Appendices

Glossary of Terms

Extraction profile	Varying rate of extraction over time.
Great Glen Way	National long distance walking route from Fort William to Inverness.
Ground Investigation works	Initial works to identify the nature of sub-surface materials.
HGV	Heavy goods vehicle.
LGV	Light goods vehicle.
MW	Megawatt – a unit of power equal to one million watts.
Scoping Opinion	The written opinion of the determining authority as to the scope and level of detail of information to be provided in an EIA report.
SEPA (Scottish Environment Protection Agency)	A non-departmental public body tasked with the protection of the environment and human health in Scotland.
Scottish Canals	The British Waterways Board, operating as Scottish Canals – Public body with statutory duty for the operation and maintenance of waterways in Scotland.
Section 36	Section 36 of The Electricity Act (1989) for an electricity generating station with an output greater than 50 MW.
SNH (Scottish Natural Heritage)	The body responsible for promoting, caring for and improving natural heritage in Scotland, and advising Government on natural heritage issues.
Spoil	The excavated rock from the underground works for The Proposed Development.
Spoil Management Plan	A detailed report evaluating options for the use of excavated spoil material which would be produced prior to commencement of underground works.
Stakeholders	Organisations and individuals who can affect or may be affected by The Proposed Development.
Statutory bodies	Public bodies with legal duties to advise and comment on planning and development matters.
Transport Scotland	The national transport agency for Scotland.

7 Spoil Management

7.1 Executive Summary

7.1.1 This Chapter presents the findings of a review of transportation and potential re-use options for excavated spoil material associated with the underground works of The Proposed Development. The review has been undertaken in consultation with stakeholders, to inform an indicative strategy for the re-use of surplus spoil[1] as a result of The Proposed Development.

7.1.2 Where feasible, excavated spoil from the underground works would be re-used in the construction of The Proposed Development. Of the total excavated spoil, it is estimated that 20% would be removed from the tunnel portal at the upper reservoir and will be used in dam and track construction. It has been calculated that approximately 0.6 million tonnes of construction aggregate would be needed for concreting operations both in the underground works and at the Lower Control Works.

7.1.3 Once the material re-used at the dam and the processed spoil used for construction aggregate has been accounted for, it is anticipated that the quantity of spoil generated by The Proposed Development will result in approximately 3.9 million tonnes of surplus material at the lower reservoir works. This will require on-site re-use or onward transportation for re-use off site. This estimate is based on the proposed 1500 MW scheme (i.e. the 'worst case scenario' in terms of the generation of excavated materials). It should be noted that spoil quantities would be reduced if a lesser capacity scheme were to be developed.

7.1.4 Various transport options have been reviewed for the export of surplus spoil material from site. This review concluded that, for the 'worst case scenario', no single transport option has the capacity to accommodate the removal of approximately 3.9 million tonnes of excavated spoil from site at the rate of extraction required. Therefore, it is anticipated that a combination of options, using both the canal and the road network would be required for the 'worst case scenario'.

7.1.5 To allow a potential reduction in road and / or canal traffic volumes during the period of dam construction, a temporary haul road to connect the lower reservoir works area to the upper reservoir and dam is proposed and has been assessed as part of The Proposed Development. The temporary haul road provides an opportunity to supplement rock quarried within the upper reservoir, with suitable tunnel spoil from the underground works, for dam construction. The viability of constructing this temporary haul road would however be dependent on a number of factors including the scale of the project (i.e. 1500 MW or less), and the outcome of the final Spoil Management Plan (see below).

7.1.6 Due to the complexity of the construction programme for the project, the timescales for future site investigation and detailed design, and the need to allow the construction

[1] Spoil material is defined as the excavated rock from the underground works. In the context of the quantities of spoil discussed in this chapter, the quantity of other near surface materials such as soils and overburden are insignificant and their re-use would be incorporated into the wider works.

contractor some flexibility in their working methods, it is not feasible to confirm committed re-use options at this time.

7.1.7 As agreed for The Consented Development, it is anticipated that a Condition of Consent would cover the implementation of the transportation and re-use of spoil, to enable the Applicant to assess the final spoil volume, identify potential receptor sites and the best practicable environmental option for transporting the excavated spoil to these locations. It is proposed that a detailed report evaluating options for the use of excavated spoil material would be outlined in a Spoil Management Plan prior to commencement of the main underground works. This study would be undertaken in full consultation with The Highland Council and other statutory bodies and stakeholders.

7.2 Introduction

7.2.1 This Chapter considers the potential options available for the transport and re-use of surplus spoil associated with the construction of the underground works for The Proposed Development. The review of these options has been undertaken in consultation with statutory bodies and other stakeholders, and an indicative strategy for the re-use and transportation of surplus spoil is presented.

7.3 Scoping and Consultation

7.3.1 A Scoping Opinion was sought from Scottish Ministers on the environmental information to be provided in the EIA Report (see Chapter 4: EIA Approach, Scoping and Consultation). Table 7.1 details the relevant comments within the Scoping Opinion with regard to the transportation and re-use of spoil, and how these have been addressed within the EIA Report.

Table 7.1: Scoping Discussions

Consultee	Summary Response	Comment/Action Taken
The Highland Council	Key matter for the project is the management of rock. Hoped that a more exact explanation / traffic impact assessment is provided in respect of surplus rock removal. Request for the impact that construction traffic will have and what mitigation is proposed, especially for rock extraction from the site.	This Chapter considers the potential transportation and re-use options of surplus spoil. An assessment of the indicative 'worst case scenario' has been undertaken and is presented in Chapter 16 (Traffic and Transport) and supporting appendices. Further assessment of relevance is included in Chapter 17 (Noise) and Chapter 18 (Air Quality).
Scottish Canals	Keen to maximise the use of the Caledonian Canal for transport of people, materials and rock to and from site. Scottish Canals has an aspiration to use this project as a springboard to promote future freight use of the canal and the development of transport infrastructure improvements (e.g. at Laggan and Inveroich Pier). Welcome opportunity to be involved in rock management strategy.	This Chapter considers the potential transportation and re-use options of surplus spoil. Consultation has been undertaken with Scottish Canals to discuss use of the canals for this project.
Transport Scotland	Request for the impact that construction traffic will have on the trunk road	An assessment of the indicative 'worst case scenario' has been undertaken and is

Consultee	Summary Response	Comment/Action Taken
	network.	presented in Chapter 16 (Traffic and Transport) and supporting appendices.
SEPA	Expect the application to be supported by an assessment of the amount of overburden and rock that will be generated, which should be demonstrated to be minimised as much as possible. There needs to be a clear idea of how and where the material will be used. Our clear preference is for the materials to be put to local beneficial use. Recommend that the assessment includes information on transport implications.	This Chapter considers the potential transportation and re-use options of surplus spoil. An assessment of the indicative 'worst case scenario' has been undertaken and is presented in Chapter 16 (Traffic and Transport) and supporting appendices.

7.3.2 Further to the Scoping Opinion responses, and as part of the EIA Process, further discussions have been held with statutory consultees and stakeholders (see Table 4.2 in Chapter 4: EIA Approach, Scoping and Consultation) to explore the options available for the transportation of surplus excavated spoil, as well as the identification of potential receptor sites. These discussions have informed the indicative strategy for the re-use of surplus spoil presented in this Chapter.

7.4 Planning History

7.4.1 As referred to in Chapter 1: Introduction and Background, an application for consent under the Electricity Act 1989 to construct and operate a 600 MW hydroelectric pumped storage scheme at Coire Glas was sought during 2012. Section 36 consent was granted on 13th December 2013, with an extension to this granted by Scottish Ministers on 14th March 2017, which is due to expire on 12th December 2021 (The Consented Development).

7.4.2 The EIA for The Consented Development considered the extraction of spoil from the site entirely by road, indicating a peak of 72 Heavy Goods Vehicle (HGV) trips per day[2] from the spoil extraction on the A82 and A87 trunk roads. Consent was granted on this basis, with a Condition of Consent attached to the consent which required a detailed report evaluating the potential uses and transport options for spoil, with a preferred Spoil Management Plan[3], to be submitted to and agreed with The Highland Council, SNH and SEPA.

7.5 Spoil Extraction

7.5.1 All underground works (i.e. tunnels, surge shaft, ventilation shaft and cavern chambers) are likely to be constructed using drill, blast, muck and haul techniques. The extracted material would range in size from approximately 450 mm diameter down to fine sands and dust due to the blasting process. This material would then be extracted from the tunnels (by means of a conveyor belt or dump trucks) to the portals.

[2] Note that other construction related HGV and Light Good Vehicle (LGV) would have been in addition to this.

[3] Referred to as Rock Disposal Plan in Section 36 Condition 3 (Part 2) of The Consented Development.

7.5.2 Where feasible, excavated spoil from the underground works would be re-used in the construction of the scheme. It is anticipated that of the total excavated spoil, it is estimated that 20% would be removed from the tunnel portal at the upper reservoir and will be used in dam and track construction. It has been calculated that approximately 0.6 million tonnes of construction aggregate would be needed for concreting operations both in the underground works and at the Lower Control Works.

7.5.3 Once the material re-used at the dam and the processed spoil used for construction aggregate has been accounted for, it is anticipated that the quantity of spoil generated by The Proposed Development will result in approximately 3.9 million tonnes of surplus material at the lower reservoir works which will require on-site re-use or onward transportation for re-use off site. This estimate is based on the proposed 1500 MW scheme (i.e. the 'worst case scenario' in terms of the generation of excavated materials). It should be noted that spoil quantities would be reduced if a lesser capacity scheme were to be developed.

7.5.4 An analysis has been undertaken to derive an extraction profile for the material and this is provided in Appendix 7.1. In the case of the 'worst case scenario', the main underground works are anticipated to extend over a 5 to 6 year period and it is estimated that the peak spoil balance requiring removal is expected to be around 4,400 tonnes per day.

7.6 Options for Re-Use of Spoil

Re-Use in Construction of the Dam

7.6.1 The ability to use excavated spoil material in the construction of the dam depends on both the construction programme/sequencing of dam construction and the suitability of the spoil.

7.6.2 In order to optimise the dam construction process, the dam would ideally be constructed in one continuous process, with suitable spoil available at a rate to allow efficient use of plant and labour resources. Preliminary scheduling of the construction process indicates that the dam could be completed quicker than the underground works. As such, it is possible that delays would be experienced should there be a requirement to wait for spoil material to be available from the tunnelling.

7.6.3 Whilst it is possible that the spoil material produced from the tunnelling would be suitable for dam construction, the following factors may prevent some or all of the material being useable:

- Characteristics of the 'as blasted' rock (not known until Ground Investigation works commence);
- Processing and handling requirements for both transportation to the upper reservoir and for dam construction; and
- Relative cost when compared to the use of a quarry situated close to the dam.

7.6.4 Should it be considered feasible to re-use spoil for dam construction, it has been determined by the project team following a review of options (see Chapter 2, Section 2.6), that the preferred solution to transport excavated spoil to the dam would be to construct a

temporary haul road to the east of the lower slopes of Meall nan Dearcag. This is described in Chapter 3: Description of Development and an indicative alignment shown on Figure 3.1: Scheme Overview.

7.6.5 This temporary haul road would offer the potential to reduce impacts on the road network and waterways, by providing an opportunity to supplement rock quarried for dam construction with suitable tunnel spoil from the underground works. However, the viability of constructing this temporary haul road would be dependent on a number of factors including the scale of the project (i.e. 1500 MW or less), and the outcome of the final Spoil Management Plan (see Section 7.10).

Re-Use at Potential Off-site Receptor Sites

7.6.6 It is likely that excavated spoil material could be used on local infrastructure projects, thereby providing additional benefit and further helping to reduce traffic numbers on the wider network. Through consultation with stakeholders (see Table 4.2 in Chapter 4: EIA Approach, Scoping and Consultation), several potential receptor sites have been identified that may benefit from the excavated spoil material, assuming that it is suitable. These include:

- Laggan Bay Breakwater (Scottish Canals);
- A82 Lochside Protection;
- Glensanda Quarry (for onward export);
- Inveroich Pier Works, Fort Augustus (Scottish Canals); and
- Fort William Marina /Cruise Terminal.

7.6.7 Although there is potential, and willingness on behalf of the Applicant, to supply local infrastructure sites with spoil material, the timescales for both The Proposed Development and some of the potential receptor sites are uncertain and suitability of the 'as blasted' rock will not be known until Ground Investigation works commence. Therefore it is not possible to commit to any potential receptor site(s) at this stage. However, it is acknowledged that use of excavated materials at any of these potential receptor sites could reduce the impact on the surrounding transport network and could also have a social and infrastructure benefit for the long term.

7.7 Local Transport Network

7.7.1 The existing transport network within the immediate vicinity of The Proposed Development is not highly developed given its rural setting and there are no formal public access roads providing vehicular access to either the upper or the lower reservoir works areas.

7.7.2 The upper reservoir works would be accessed off the A87 at White Bridge (Invergarry) utilising existing forestry tracks (some of which require to be upgraded) and the creation of new tracks. The lower reservoir works, as well as the excavation of spoil for the majority of the underground works, would be accessed off the A82 at North Laggan, following the West Loch Lochy Road (known locally as the Kilfinnan Road) and forestry tracks, both of which would require upgrading. Kilfinnan Road forms part of National Cycle Route 78 and the Great Glen Way, and is also used by pedestrians.

7.7.3 The Kilfinnan Road joins the strategic trunk road network at Laggan Locks. A simple priority junction provides access to and from the A82 trunk road. The Kilfinnan Road will be upgraded as part of The Proposed Development to allow safe use by the predicted traffic.

7.7.4 The A82 provides connections to Inverness to the northeast and Fort William to the southwest of The Proposed Development. It is managed on behalf of Transport Scotland by BEAR Scotland.

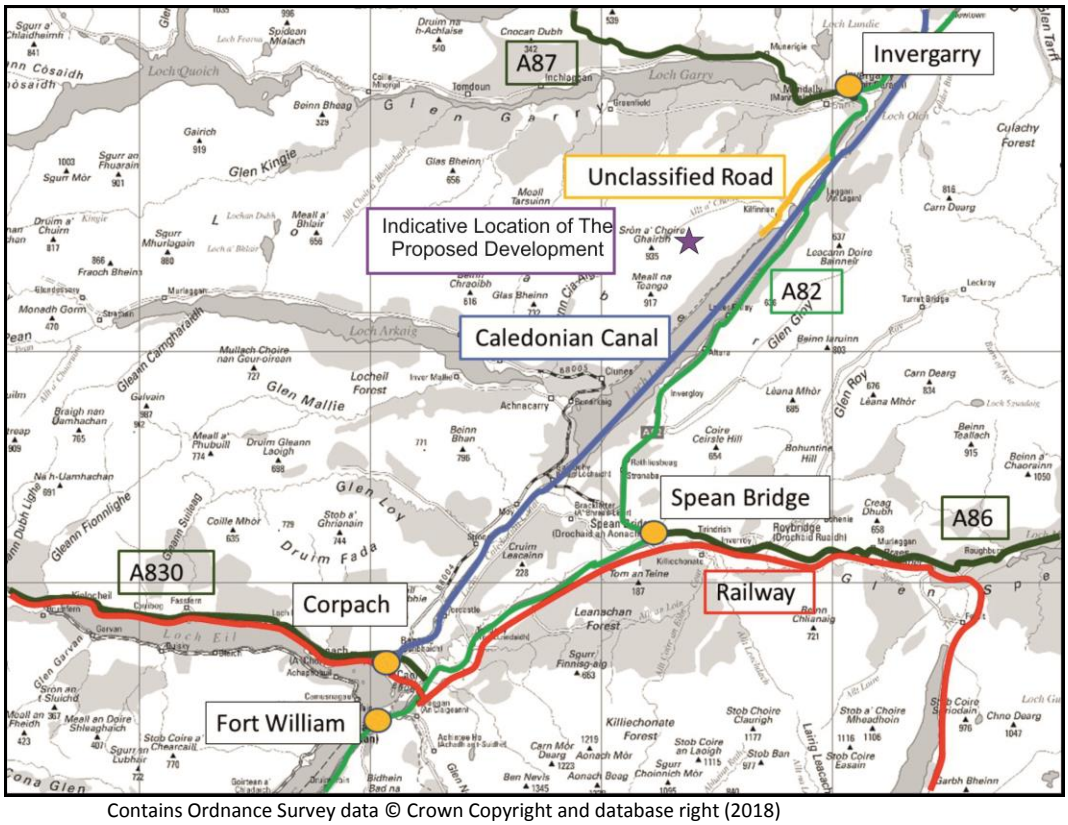
7.7.5 The closest point to the national rail network is at Spean Bridge, approximately 9 miles to the south of The Proposed Development. Spean Bridge is located on the West Highland Line, connecting Fort William and Glasgow for passenger and limited freight operations. There is a small yard at Spean Bridge and a passenger station.

7.7.6 Loch Lochy forms part of the Caledonian Canal, connecting Corpach to the southwest, with Inverness to the northeast. The canal is operated by Scottish Canals and is predominantly used by leisure craft.

7.7.7 The canal is controlled by locks along its route, the largest being Neptune's Staircase at Banavie, near Corpach. This features eight connected locks to raise the canal from sea level to the canal level at Banavie.

7.7.8 The transport network described above is shown in Plate 7.1 below.

Plate 7.1: Transport Network within the vicinity of The Proposed Development



Contains Ordnance Survey data © Crown Copyright and database right (2018)

7.8 Transportation of Surplus Spoil Material from Site

7.8.1 This section provides a review of options for the transport of surplus spoil from the lower reservoir works.

Road Extraction

7.8.2 It is anticipated that removal of spoil by road would be undertaken using 20tonne capacity, 4 axle HGVs. These vehicles would be loaded at the lower reservoir works and then driven along the access track to the unclassified public road (Kilfinnan Road) before joining the A82 trunk road. An example of a typical vehicle is shown in Plate 7.2.

7.8.3 From the A82, loads could proceed northeast towards Inverness or southwest to Corpach and Fort William. Loads could also join the A87 and proceed towards Kyle of Lochalsh or join the A86 towards Laggan and the A9, should there be a demand for material.

7.8.4 It is anticipated that the most likely destination for material would be to Corpach, where the loads would be tipped and stored at or near the harbour for onwards export.

7.8.5 An initial assessment for HGV export has been undertaken based on all spoil material transported from site by road, assuming immediate extraction from site on each day. The assessment indicates that, for this 'worst case scenario', the peak export by road would be 445 vehicle trips (223 vehicles Inbound and 223 vehicles Outbound per day) occurring for approximately a seven month period.

Plate 7.2: Typical 20 Tonne HGV Tipper

7.8.6 This level of traffic is equivalent to an average of 56 vehicles per hour, assuming an 8 hour working day. Whilst this level is low in numerical terms, the impact that it would have on the unclassified road and the receptors on this link would be considerable. Potential impact on the operation of the A82 junction at Kilfinnan Road from this level of traffic would also be considerable.

7.8.7 On this basis, and for the 'worst case scenario', it is not considered that extracting all spoil material from the site by road would be acceptable from a technical, environmental or practical outlook.

Canal Extraction

7.8.8 The Caledonian Canal was designed by Thomas Telford and was opened to traffic in 1822. The commercial and military traffic that was envisaged for the canal was never really met and the canal is now mainly used by leisure and tourist traffic.

7.8.9 Through consultation, Scottish Canals have indicated that there are currently no suitable barges that could operate on the canal that would be of sufficient design and operational characteristics that could efficiently move the volume of materials under consideration.

7.8.10 For canal extraction to be possible, a fleet of specialist barges would need to be constructed that could maximise the draft, beam and length restrictions that are required in order to pass through the lock gates along the canal. It is anticipated that this type of vessel would have a capacity of 1,000 tonnes and would need to be loaded using a mobile conveyor belt working in conjunction with a wheeled excavator / loader from the jetty at the lower reservoir works. A fleet of barges and pusher vessels would then be required to transport the spoil material. The barges could also be used to bring concrete ingredients such as sand and cement to site and could therefore reduce the impact of these materials on the trunk and local road network.

7.8.11 The most feasible location for barge discharge would be Corpach, where the barges could either be transported onto a further location (e.g. Glensanda Quarry), or discharged at Corpach for onward shipping by, for example, rail or onto a seagoing vessel for export.

7.8.12 Corpach is the favoured option over Inverness as it is a shorter transit time and minimises the impact at locks (as much as possible) and reduces the impact on swing bridges where the trunk road network crosses the canal.

7.8.13 Scottish Canals estimate that a typical transit of the canal from site to Corpach would be as set out in Table 7.2.

Table 7.2: Transit Time through the Caledonian Canal

Section	Journey Time
Site – Gairlochy	1 hour
Gairlochy – Banavie (Prior to Neptune's Staircase)	1 hour
Neptune's Staircase	1 hour, 30 minutes
Banavie Lower - Corpach	1 hour
Total	**4 hours, 30 minutes**

7.8.14 The timings in Table 7.2 assume a clear run along the canal without delay from other canal traffic. Given that the operation from site to Corpach will take up to five hours, excluding load discharge, it is likely that barges will require a full working day to depart and return to site.

7.8.15 It is possible for several vessels to be within the lock flight at Neptune's Staircase and as such, there is potential capacity for at least four vessels proceeding at the same time in the same direction, with one lock separation. The use of a drone vessel through the lock flights could be utilised to help push the barges through the flight.

7.8.16 Using a 1,000 tonne barge, it is estimated that at the peak of extraction, 5 outbound and 5 inbound barges would be required based on all spoil material transported from site by canal, assuming immediate extraction from site on each day.

7.8.17 Factors including design of barges; loading and unloading facilities and operational arrangements mean that it is not possible at this time to comprehensively assess the feasibility of extracting the full volume of spoil material from the site by canal. Known factors including the barge capacity constraint at Neptune's Staircase, lead to the conclusion that making a commitment to extracting all spoil material by barge at this time would not be possible, and a 'composite' solution using a combination of road and canal transport has been assessed as representing the 'worst case scenario'.

Rail Extraction

7.8.18 The advantage of rail access is that spoil transported by rail can reach a vast area of the UK without impacting upon the roads network. However, there is no rail link in the immediate proximity of The Proposed Development.

7.8.19 The former Invergarry and Fort Augustus Railway track bed is located on the eastern shore of Loch Lochy. It is not considered feasible to relay this railway for the following reasons:

- There are numerous structures on the route that would require replacement or strengthening;
- There is no longer an appropriate mainline connection;
- A new trunk road crossing would be required;
- Sections of the track bed appear to have been built upon;
- The costs are likely to be excessive for a relatively short period of use; and
- The topography of the loch side near the track bend does not suit a rail transfer station.

7.8.20 Other locations on the rail network include Spean Bridge, Fort William and Corpach. Of these, Corpach offers the greatest potential and could act as a strategic transhipment facility.

7.8.21 In summary, it is concluded that the rail network could offer some potential to transport excavated spoil material to receiver sites, should the need arise. This would require the use of road or canal transport to an appropriate location on the rail network. This would be subject to further study as part of the Spoil Management Plan (see Section 7.10).

7.9 Assessment Scenario for Re-use of Spoil

7.9.1 Following a review of the options available for the transportation of excavated material from site, based on the 'worst case scenario', it is considered that no single extraction method (see Section 7.8) has the capacity to accommodate the removal of all spoil material at the rate required.

7.9.2 Furthermore, whilst there is a willingness from the Applicant, and potential to supply local receptor sites with excavated spoil material, the timescales for both The Proposed Development and some of the potential receptor sites is uncertain. Also, no Ground Investigation works have been carried out at present to determine the potential suitability of the spoil. Therefore, it is not possible to commit to any potential receptor site(s) at this time.

7.9.3 Given the uncertainty associated with the ability to use tunnel spoil in the construction of the dam, the viability of constructing the temporary haul road and the potential to use the Caledonian Canal to transport all spoil, the scenario (in transport terms) that is assessed in this EIA Report for the re-use and transportation of spoil assumes that circa 3.9 million tonnes of excavated material is transported off site. This would result in the following peak road and canal traffic scenarios:

- HGV Road access from the site of no more than 120 trips per day[4] (1200tonnes per day) accessing the trunk road network and allowing access to the A82 (north and south), A86 (east) and A87 (west). This represents fewer than 9 loaded vehicles per hour departing the site (assuming a 7 hour working day), which is considered to be within acceptable levels of disturbance and impact on the trunk road network; and
- Transport to Corpach by 1,000tonne barge on the Caledonian Canal for residual material. At the peak of operation this would result in 3 loaded barges per day leaving the site.

7.9.4 Detail of this is provided in Appendix 7.2.

7.9.5 As discussed in Section 7.6.4 and 7.6.5 (see also Chapter 3: Description of Development), The Proposed Development includes the construction of a temporary haul road to connect the lower reservoir works with the upper reservoir works. It has been estimated that up to 1.9 million tonnes of excavated spoil material could be incorporated into the construction of the dam should tunnel spoil be suitable. This has the potential to reduce road and / or canal traffic volumes during the period of dam construction (see Chapter 16: Traffic and Transport).

7.9.6 An assessment of the temporary haul road has been included where relevant in this EIA Report.

[4] Note that other construction related HGV and Light Good Vehicle (LGV) would be in addition to this, as described and assessed in Chapter 16: Traffic and Transport.

7.10 Next Steps

7.10.1 Due to the complexity of the construction programme for the project, the current lack of site investigation and detailed design, and the need to allow the construction contractor some flexibility in their working methods, it is not feasible to confirm committed spoil re-use and transport options at this time.

7.10.2 As agreed for The Consented Development, it is anticipated that a Condition of Consent would cover the implementation of the transportation and re-use of spoil, to enable the Applicant to assess the final spoil volume, identify potential receptor sites and the best practicable environmental option for transporting the excavated spoil to these locations. The Condition of Consent for The Consented Development states:

Prior to the Commencement of Development, a detailed report evaluating options for the use of all excavated rock material, with a preferred Rock Disposal Plan, must be submitted for the approval of the Planning Authority, who must consult with SEPA and SNH. The report must be prepared with input from suitably qualified professionals. It must:

- *Identify the final volumes and likely nature of the rock to be excavated;*
- *Identify the potential use of all excavated rock either as part of the Development or for other construction projects or uses in the general locality;*
- *Identify any temporary or long term storage requirements on or off Site;*
- *Identify all traffic impact consequences, including use of the Caledonian Canal and moving the excavated rock material from the tunnel portals to on or off Site locations;*
- *Assess the feasibility and environmental impact of each option, and identify the need for any additional planning permissions or licences;*
- *Assess the feasibility and environmental impact of each option, and identify the need for any additional planning permissions or licences; and*
- *The Development must be implemented in compliance with the approved Rock Disposal Plan, including any planning permissions that will be required for any specific elements of the approved Rock Disposal Plan that are in addition to the provisions of this consent unless otherwise agreed in writing with the Planning Authority.*

7.10.3 It is therefore proposed that a detailed report evaluating options for the use of excavated spoil material would be outlined in a Spoil Management Plan prior to commencement of the main underground works. This study would be undertaken in full consultation with The Highland Council and other statutory bodies and stakeholders.

7.10.4 The potential environmental effects of the transportation from site of excavated spoil has been undertaken in this EIA Report with respect to the following assessments: Chapter 16: Traffic and Transport, Chapter 17: Noise and Vibration and Chapter 18: Air Quality.