APPENDIX 7.3

PEAT LANDSLIDE HAZARD AND RISK ASSESSMENT

Proposed A82 Bypass at Crianlarich:

Peat landslide hazard and risk assessment

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CONTENTS

SUMMARY

An assessment of the existing information on peat depths along the route of the proposed bypass was made. A site visit was undertaken by Dr Alistair Headley (PlantEcol) and Megan Hooper (Grontmij) on 21st and 22nd April and spot measurements of the depth, type of peat present and degree of humification at various locations was made with a gouge auger. The extent of areas of deep peat (>0.5m deep) were made plotted on a base map of the area with reference to the topography, hydrology and using a GIS receiver to locate positions with an accuracy of typically 6 to 8m.

The survey found that there were thirteen areas of peat more than 0.5m deep along the route or immediately adjacent to the proposed bypass with a further three up to 200 m upslope of the bypass within the forestry plantation. The areas of peat on the northern and western parts of the survey area were relatively shallow areas of peat (typically between 0.2 and 1 m deep) in flushed concave hollows immediately below the forestry plantation. In the southern part of the survey area the peat was largely present in basins between moraines and had deeper peat that was typically 0.4 to 1.5 m thick. There is one particularly deep body of peat, at least 4 m deep, immediately adjacent to the extant A82 which is not capable of failing as it is retained by the roads embankment.

The majority of the peat is a well-humified sedge peat, with significant quantities of silt and sometimes sand towards the base of the peat. The peat in most cases sits directly on top of bedrock or boulders. This is likely to reduce the potential for a peatslide to occur. Other factors that reduce the likelihood of peatslides occurring are the lack of peatpipes, lack of compression features or tension cracks in the peat, concave slopes, shallow peat, lack of any evidence of past debris flows or ‘peat creep’.

One area of peat immediately downslope of the proposed bypass may be affected by changes to its hydrology through drying out of the peat. Although the hazard from this body of peat sliding downhill is high, the probability of this event occurring is considered to be very low and therefore unlikely to occur.

A number of recommendations are made with regard to the construction of the proposed bypass that would eliminate or minimise the risk of peatslides and bog bursts occurring.

2. INTRODUCTION

2.1 Background

In the past decade there have been a number of landslides involving the mass movement of peat, especially those associated with developments (Winter *et al.* 2005). In some cases these have blocked roads such as the A970 on Shetland on 19th September 2003. This increased awareness has stimulated the need to identify the causal factors associated with peat slides and bog bursts and to attempt to predict the likelihood that one or more peat slides may occur during or after a development on or close to a peatland.

The factors that have been identified as most likely to trigger or give rise to peat slides by the Scottish Executive (2006) are:

(i) Increase in mass of the peat slope through progressive vertical accumulation (peat formation);
(ii) Increase in mass of the peat slope through increases in water content;
(iii) Reduction in shear strength of peat or substrate from changes in physical structure caused by progressive creep and vertical fracturing (tension cracking), chemical or physical weathering or clay dispersal in the substrate;
(iv) Loss of surface vegetation and associated tensile strength; and
(v) Increase in buoyancy of the peat slope through formation of subsurface pools or water-filled pipe networks.

2.2 Scope and Aims

Dr Headley was commissioned by Grontmij to investigate the likelihood that a peat slide may occur in the vicinity and along the route of a proposed bypass on the A82 around the south-western side of Crianlarich in the Council District of Stirling.

3 METHODS

A site investigation was carried out on 21st and 22nd April 2008 by Dr Alistair Headley and Megan Clevely. On both days the weather was dry with sunny periods. The depth and type of peat present at selected locations along, above and below the proposed route of the bypass was ascertained using a gouge auger on the 21st April. The locations for testing peat depth and type were selected on the basis of topography, hydrology and surface vegetation that indicate the presence of deep peat (>0.5m) as well as covering areas not previously investigated by Holequest. Where appropriate the macrofossil content of the peat was examined using a x20 handlens. The level of humification of the organic matter was assessed using the 10 point scale devised by Von Post (1924). The texture of the material was determined by manual handling and where appropriate, the presence of fine-grained mineral matter was ascertained by placing a small quantity of material between the investigators front teeth. The location of each sample point was taken using a Garmin Geko GPS receiver. This typically had an accuracy of horizontal distance of 6 to 8m.

On 22nd April the extent and location of the basins with deep peat were mapped using existing maps of the proposed route, a Garmin Geko GPS receiver to plot locations. A wooden 1m long peat probe was used to ascertain whether deep peat (>0.5m) was present. The presence of deep peat within the forestry plantation was also investigated at the same time. The main slope elements were mapped on the same day using standard geomorphological mapping symbols using a compass-clinometer and basemap.

The data on the distribution and depth of deep peat collected from this survey was combined with the data collected by Holequest in 2007 and 2008 when they were testing the depth of soft ground along the route of the road. This combined information was used to plot the distribution of areas of deep peat (Figure 1) and to assess their overall and maximum depth (Table 1).

No samples of peat were taken for laboratory testing as this was not requested by Grontmij and neither was it considered necessary. Firstly, the collection of samples of peat often changes its physical properties and the tensile strength of peats is very similar to those of soft soils with values around 10 kPa (reference).

4 RESULTS

4.1 General observations

The peat along the route of the proposed bypass and in the immediate areas is restricted to either small basins or flushed slopes and these are delineated in Figure 1. There are no areas of what would be termed blanket bog peat. The field examination of the peats suggests that they are largely composed of sedge peat with varying amounts of silt and sand present depending on the proximity of a watercourse. The peat has significant quantities of wood present, especially towards the bottom of the profiles of peat. These layers probably represent a pre-forest clearance phase of deposition of peat. Most of the peat is well humified and rather amorphous and consequently it is sometimes difficult to determine the dominant plant remains within the peat in the field.

4.1.1 Areas A, B, C, D, E and G

These flushes (poor-fen) are dominated by rushes (*Juncus acutiflorus*), purple moor-grass (*Molinia*) and bogmosses (mostly *Sphagnum fallax* and *S. denticulatum*), and are typical of ground-water (soligenous) dependent mires with low concentrations of mineral nutrient in the ground-water. These types of peatland (flushes and valley mires) typically have shallow peats composed mostly of the well humified (H8 or H9 on the Von Post scale) remains of sedges, rushes and grasses. There is an occasional deep hollow filled with peat in areas A and D (Table 1). Most of the peat sits directly on top of the bedrock, or in one case, a sandy-clay.

Area G is a particularly large flush that extends around a moraine and upslope between a small drainage channel and a path (West Highland Way). There may be the occasional deep peat-filled hollow present in this area.

4.1.2 Areas F, H, I, J, K, L and M

These areas of peat are located in hollows between hummocks and ridges of glacial origin (hummocky terrain) and are types of basin mire. They stay permanently wet due to the topography and are dominated by a mixture of cotton-grass (*Eriophorum* spp.), purple moor-grass, bogmosses and various sedges (*Carex* spp.). The peat in these basins tends to be much deeper than that in the flushes and valley mires (Table 1). Basin J is by far the deepest of the basin mires and is at least 5m deep. Areas H, K and M also have deep pockets of peat and are up to at least 2.8 m deep (Table 1). The median depth of peat measured is around 1m (Table 1).

Most of the peat is again well-humified and dominated by the remains of sedge, but towards the bottom of the basin peats there are significant quantities of wood (probably birch). In places the peat is underlain by a sandy-silt. However, in most cases it was not possible to sample the underlying mineral material as the peat appeared to be lying directly on top of the underlying bedrock or large stones.

Area K is a complex set of connected three basins with contiguous deep peat (Figure 1). The north-eastern arm of the area is at a lower elevation in a separate basin connected by a short steeper slope to the western and southern basins. The western arm of the basin is a relatively narrow channel that extends upslope and has a relatively shallow peat. The peat mass in the southern basin within this area is relatively flat and is mostly 1 to 1.5m deep.

4.1.3 Areas N, O and P

There are three small basins of peat, probably quite deep, within the forestry plantation a short distance upslope of the proposed bypass (Figure 1). The peat bodies are held in place by lips in either the bedrock or glacial deposits on the slope. The planting of trees in these basins has been avoided because the foresters knew that tree growth would be poor or non-existent. The peat present in area N is particularly wet.

4.2 Field Observations of pre-failure indicators of instability

Failure scars or cracking, either historical or recent, were not observed in the peat masses, nor was there any evidence of past debris flows ever occurring. There were no features indicative of tension or compression in any of the peat bodies observed and neither was there any evidence of ‘peat creep’.

The water bodies in the area were aerial drainage networks. In most cases they were drainage ditches or artificially depended and straightened natural water courses. Seepages and flushes were present in areas A, B, C, D, E, G and parts of K and M. No peat pipes were seen in the watercourses or drainage ditches.

5 EVALUATION OF STABILITY

5.1 Peatslide Hazard

The ‘factors of stability’ were calculated for each of the identified units of peat using the infinite slope equation:

$$F = \frac{c' + (\gamma - m\gamma_w) z \cos^2 \beta \tan \emptyset'}{\gamma z \sin\beta \cos\beta}$$

where c' is the effective cohesion of the peat,
γ is the bulk unit weight of saturated peat,
γ_w is the unit weight of water,
m is the height of the water table as a fraction of the peat depth,
z is the peat depth in the direction of normal stress,
β is the angle of the slope to the horizontal and
$\emptyset'$ is the effective angle of internal friction.

A value of 10 kPa was taken for c' as this is typical of peat and most soft soils, whilst the bulk density of peat is typically between 1.0 and 1.05 kg dm^{-3} (Charman 2002, Helenelund & Hartikainen 1972). When the peat is most likely to slide it is saturated and therefore the height of the water table is equal to the depth of peat and therefore m will equal unity.

Peat bodies A, B, C, D, G, H, I, J and K are totally or partly along the route of the proposed development and will have all or some of their peat buried or removed.

Using the above stability analysis, the likelihood of a peatslide occurring is either negligible or unlikely (Table 1). Three of the peat bodies (C, D and E) exhibit factors of safety below 100. This simplistic calculation is based on a uniform depth of peat and the rather varied peat depths associated with the highly undulating underlying bedrock and mineral layers is most likely to increase the factor of safety. Therefore, I would regard these calculations as under-estimating the level of safety as the varying bathymetry will reduce the sections of peat where peat can slide over a uniformly flat surface to negligible amounts. In addition, evidence on the ground suggests that these deposits of peat have not failed in historical times and have been present in their present form for many hundreds or even thousands of years. Peat bodies C and D will be destroyed as a result of the development and therefore the likelihood of a peat slide after the development is not relevant to these two bodies of peat.

Area E is below the proposed route of the bypass, but it may be affected indirectly by the amount of water reaching it through the interception of water that would normally reach this flush from upslope. This is irrespective of whether a catch ditch is installed around the margins of the road. The consequent reduction in water supply to the peat body at E is likely to result in the surface drying out and cracking and therefore make it more susceptible to failure during heavy rainfall events after a dry summer. Whether this is sufficient to make this small body of peat unstable through increased supply of water to the underlying mineral substratum is not clear. The hazard posed by a slide or flow of peat from this area is high as it would flow down towards the A82 where it passes under the railway bridge at Crianlarich itself. The risk of such a flow of peat is, however, considered to be highly unlikely because this area of peat lies in a concave basin (Figure 2), it is a relatively shallow body of peat and it sits on top of bedrock or boulders (Warburton *et al*. 2004).

The only peat bodies upslope of the proposed bypass that will have a toe removed and be potentially affected after the development is completed are H and K. Peat body H will have the majority of its area buried or removed as a result of the development. Once the proposed development is in place with its associated embankment it should retain the remaining area of peat not buried by the proposed bypass. However, for the southern basin of peat body K the proposed development will result in the remaining area of peat perched above the southern roundabout and road. This will reduce the stability of the peat and may make it susceptible to slumping on to the road rather than necessarily resulting in a peat slide as the surface gradient of this area of peat is low, i.e. less than 2°. The cutting in to the peat will increase the drying out of the peat body significantly during summer and will give rise to cracking of the peat.

Although the peat body N within its basin is currently very stable, it has the strong potential to flow downslope on to the proposed development if the mineral deposits or bedrock that currently hold it in place is removed or weakened by the construction work. This is because it is a relatively fluid mass of peat that will have very low effective cohesive strength.

Peat bodies O and P are considered to be too small and too far from the proposed development to be affected by the development or to have negligible or non-existent threat of sliding downslope on to the proposed development. The only other peat bodies upslope of the proposed development that will not be directly impacted by the proposed development are L and M. These peat basins are retained within glacial deposits with a very low probability of failing and therefore flowing/sliding on to the proposed development after completion. If peat body M were to fail it is most likely to flow in a south-easterly direction on to the existing A82 and not on to the new section of the bypass.

5.2 Bog Burst Hazard

The largest mass of peat in any one of the mires (K) is approximately 2,000 to 4,000 m^3 (Table 1). This body of peat is unlikely to result in a bog burst for three reasons. Firstly it is confined by the walls of the mounds composed of till deposits and has very few places, if any, where it can flow to. Secondly there is insufficient mass of peat to flow downhill and there are no indicators of potential instability and finally there is very little slope to the surface of this mire to increase its instability.

6 RECOMMENDATIONS

- Establish the impact of the proposed development on the hydrology and therefore stability of peat body E at grid reference NN38330,25260.
- During construction any peat bodies that are along the route of the bypass should ideally have their peat removed. This is recommended to avoid the potential for subsidence of the road surface and embankments to occur after construction as a result of buried peat decomposing and compressing.
- Construction vehicles should avoid crossing bodies of deep peat that are not to be removed or buried by the proposed development. If there is damage to the integrity of the vegetation or underlying peat it will make the body of peat more susceptible to failure during or after construction.
- An assessment should be made as to whether the construction of the cuttings for the road immediately to the east and downslope of peat body E will affect the integrity of the bedrock and/or glacial deposits that retain peat body N.
- It is recommended that gently sloping batters of less than 15º are put in place around the cutting to the southern roundabout of the development to minimise the likelihood of peat within basin K sliding on to the road during heavy rainfall events.

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Table 1. Summary table of depths, slope and aspect of peat units and their stability analysis and peat slide hazard for the proposed A82 bypass at Crianlarich. Values in parentheses are for upper and lower limits of stability analysis (*F*).

Unit	Location (NGR)	Type of mire	Depth of peat (m)			Slope	Aspect	Area (ha)	Stability Analysis (*F*)	Peat slide hazard
			median	inter-quartile range	maximum					
A	23805,72548	Flush	0.67	0.4 – 0.9	2.32	4º - 7º	NW	0.214	(69)-190-(229)	unlikely
B	23813,72544	Flush	0.5	0.28 – 0.65	1.3	8º - 13º	NNE	0.078	(62)-129-(180)	unlikely
C	23821,72537	Flush	0.7	0.5 – 1.0	1.6	12º - 15º	N	0.319	(34)-72-(88)	unlikely
D	23828,72530	flush/valley	0.7	0.17 – 1.2	2	11º	ENE	0.132	(30)-84-(347)	unlikely
E	23834,72525	Flush	0.85	0.65 - 1	1	8º - 12º	NE	0.155	(76)-80-(84)	unlikely
F	23838,72520	Basin	0.6	0.55 – 0.65	0.8	3º	E	0.185	(266)-354-(386)	negligible
G	23835,72514	flush/valley	0.68	0.5 – 0.99	1.57	9º	NE	0.294	(46)-105-(143)	unlikely
H	23834,72496	Basin	0.9	0.79 – 1.53	2.35	4º	NE	0.234	(68)-177-(202)	negligible
I	23838,72495	Basin	0.49	0.43 – 0.6	0.9	2º	E	0.023	(354)-650-(741)	negligible
J	23838,72487	Basin	1.34	0.63 – 2.4	> 5.0	3º	NNE	0.233	(43)-159-(337)	negligible
K	23828,72477	Basin	0.98	0.5 – 1.5	2.8	2º - 10º	NE	0.452	(114)-129-(637)	unlikely
L	23829,72491	Basin	0.8	0.5 – 1.0	1.25	2º	ENE	0.123	(255)-398-(637)	negligible
M	23823,72470	basin/flush	1.2	0.7 – 1.55	2.5	3º	SSE	0.237	(85)-177-(304)	negligible
N	23825,72517	Basin			>2	1º	E	0.082	318	negligible
O	23816,72512	Basin				1º	E	0.014	>100	negligible
P	23820,72519	Basin				2º	NNE	0.010	>100	negligible

8 APPENDIX 1

Field description of stratigraphical examination of peat
Date: 21st April 2008
Surveyor: Dr Alistair Headley with assistance from Megan Hooper
Equipment: gouge auger with spatula and x20 handlens

Location 1
NGR: NN 38298,24747 Accuracy: 6m Slope: 2º
Total depth of peat: 1.49m
Underlying substrate: clayey silt with some sand

Depth (cm)	Description	Humification
0 – 28	unsampled (unconsolidated)	
28 – 45	*Sphagnum* peat	H3
50 – 100	Well decomposed dark brown *Sphagnum* peat	H9
100 – 150	As above, but with some lumps of wood	H9
150 – 159	Clayey silt with some sand	H9

Location 2
NGR: NN 38240,24794 Accuracy: 5m Slope: 5º Aspect: 80º
Total depth of peat: 0.50 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 45	Fairly well humified with some *Sphagnum* and sand	H8
45 - 50	Very well humified peat with lots of sand	H9

Location 3
NGR: NN 38222,24806 Accuracy: 6m
Total depth of peat: 0.96 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 46	unsampled	
46 – 96	Peat with large amounts of sand and significant quantity of roots; light brown	H8

Location 4
NGR: NN 38252,24810 Accuracy: 6m Slope: 10º
Total depth of peat: 1.57 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 107	unsampled	
107 - 157	Sedge peat with little structure. Some sand and *Sphagnum*. Very dark brown	H9

Location 5

NGR: NN 38267,24819 Accuracy: 6m Slope: 4º Aspect: 40º
Total depth of peat: 1.39 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 89	unsampled	
89 – 139	Sedge peat with some sand	H9

Location 6
NGR: NN 38291,24832 Accuracy: 5m
Total depth of peat: 2.56 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 20	Very rooty sedge peat with some *Sphagnum*	H4
20 – 200	Humified sedge peat	H8
200 – 256	Highly humified sedge peat with some wood. Dark brown	H9

Location 7
NGR: NN 38313,24857 Accuracy: 6m
Total depth of peat: 0.52 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 20	Very rooty sedge peat with some *Sphagnum*	H4
20 – 200	Humified sedge peat	H8
200 – 256	Highly humified sedge peat with some wood. Dark brown	H9

Location 8
NGR: NN 38314,24858 Accuracy: 6m Slope: 1 – 2º
Total depth of peat: 2.8 m
Underlying substrate: rock

Depth (cm)	Description	Humification
100 – 200	Humified dark brown sedge peat	H8
200 – 250	Woody material in well humified matrix of possibly sedge peat	H9
250 – 280	As above	H9

Location 9
NGR: NN 38285,24924 Accuracy: 6m
Total depth of peat: 1.25 m
Underlying substrate: rock

Depth (cm)	Description	Humification
20 – 75	Humified dark brown sedge peat	H8
75 – 125	Dark brown sedge and wood peat with some sand present.	H9

Location 10
NGR: NN 38341,24997 Accuracy: 6m
Total depth of peat: 0.71 m
Underlying substrate: rock

Depth (cm)	Description	Humification
21 – 71	Well humified wood peat with some sandy matter at the base	H9

Location 11
NGR: NN 38348,25011 Accuracy: 6m
Total depth of peat: 0.86 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 - 76	Relatively unhumified *Sphagnum* peat with stone and wood	H4
76 - 86	Humified peat rich in clay and sand	H9

Location 12
NGR: NN 38333,25087 Accuracy: 6m Slope: 10º
Total depth of peat: 0.65 m
Underlying substrate: rock

Depth (cm)	Description	Humification
15 – 65	Sedge peat with some sand	H8

Location 13
NGR: NN 38309,25085 Accuracy: 6m
Total depth of peat: 0.30 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 20	Sedge peat	H8
20 – 30	Sandy peat	H9

Location 14
NGR: NN 38337,25110 Accuracy: 6m
Total depth of peat: 0.94 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 94	Humified sedge peat with some silt	H9

Location 15
NGR: NN 38329,25138 Accuracy: 6m
Total depth of peat: 1.5 m
Underlying substrate: rock

Depth (cm)	Description	Humification
100 – 150	Silty peat with wood fragments. Highly humified	H9

N.B. 10m upslope the peat is only 20 cm deep

Location 16
NGR: NN 38357,25199 Accuracy: 6m
Total depth of peat: 1.1 m
Underlying substrate: rock

Depth (cm)	Description	Humification
60 – 110	Well humified sedge peat	H9

Location 17
NGR: NN 38272,25285 Accuracy: 6m
Total depth of peat: 1.33 m
Underlying substrate: rock

Depth (cm)	Description	Humification
83 – 133	Dark brown sedge peat with some *Sphagnum* and coarse sand made of silica	H8

Location 18
NGR: NN 38225,25294 Accuracy: 7m
Total depth of peat: 0.60 m
Underlying substrate: rock

Depth (cm)	Description	Humification
10 – 60	Well humified sedge peat with some sand	H9

N.B. edge of peat filled basin at NN 38195,25296.

Location 19
NGR: NN 38214,25292 Accuracy: 6m
Total depth of peat: 0.95 m
Underlying substrate: rock

Depth (cm)	Description	Humification
45 – 95	Well humified sedge peat with	H9

Location 20
NGR: NN 38321,25259 Accuracy: 6m Slope: 8º Aspect: 360º
Total depth of peat: 0.5 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 50	Very well humified silty sedge peat with some stones and lumps of wood. Very dark brown and slightly greasy	H9

Location 21
NGR: NN 38211,25335 Accuracy: 6m Slope: 12º Aspect: 20º
Total depth of peat: 0.48 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 48	Unable to sample.	

Location 22
NGR: NN 38200,25347 Accuracy: 8m
Total depth of peat: 0.5 m
Underlying substrate: sandy clay

Depth (cm)	Description	Humification
0 – 50	*Sphagnum* peat with some sand	H4
50 – 70	Very sandy clay with stones and grit. Chestnut brown and very sticky	

Location 23
NGR: NN 38131,25415 Accuracy: 6m Slope: 8º Aspect: 20º
Total depth of peat: 0.52 m
Underlying substrate: rock

Depth (cm)	Description	Humification
0 – 40	Moderately humified sedge peat.	H7
40 - 52	Well humified sedge peat with high sand content, especially at base	H9

Location 24
NGR: NN 38052,25488 Accuracy: 6m Slope: 4º Aspect: 340º
Total depth of peat: 1.30 m
Underlying substrate: rock

Depth (cm)	Description	Humification
80 – 130	Woody peat within a well humified matrix. No silt	H9

Location 25
NGR: NN 38034,25508 Accuracy: 6m
Total depth of peat: 1.25 m
Underlying substrate: rock

Depth (cm)	Description	Humification
75 – 125	Sedge peat with some lumps of wood	H9

It was not possible to sample the peat at the following locations:
mostly 20 cm deep at NN 38125,25396, but between 20 and 50cm;
39cm deep at NN 38078,25455;
20 to 30cm deep at NN37984,25528;
25 cm deep at NN 38266,24838;
30 cm deep at NN 38346,24997.

No peat present at the following grid references:
NN 38305,25214;
NN 38310,25261;
NN 38345,25207;
NN 38288,25194 (Slope 20º, Aspect 30º);
NN 38180,25358;
NN 38168,25390;
NN 38097,25391;
NN 38084,25423 and

at NN 38325,25228 there was 20 cm of peaty silt.

Drawing Path :
F:\4460\proj\P0000390600 Environment Multi-jo\A82 Crianlarich\CAD\P390600-Fig 1 rev 1Extents of Peat.dwg

LEGEND

Existing
- Fencelines
- Minor Tracks / Paths
- Existing West Highland Way
- Overhead Electricity Cables
- Existing Roads / Tracks
- Buildings
- Railway Tracks
- Woodland
- River
- Watercourses
- Water Spreads

Proposed Design
- Carriageway
- Verges
- Embankments in Cut
- Bund / False Cut
- Embankments in Fill
- Bund / False Fill
- Top of Bund
- Paved Areas
- Re-aligned West Highland Way
- Peat Deposits >0.5m Depth (Labels Refered to in Report)

No.	Date	Revision	By	Chk
1	July. 08	Final Issue	IBA	AH
0	June. 08	First Issue	IBA	AH

Drawn:	Checked:	Approved:	Date:
IBA	HC	AH	30.06.2008

Client / Project
Transport Scotland
Trunk Road Infrastructure
& Professional Services

The A82 Trunk Road (Crianlarich Bypass) Peat Landslide Hazard and Risk Assessment

Title
Figure 1:
General Layout Showing The Extents Of Deep Peat Bodies / Areas

Drawing Status
Final

File Ref : P00000346600 | Drawing No : 346600-Fig 1
Original Size: 420x297 - A3 | Scale : 1:4000 | Rev : 1

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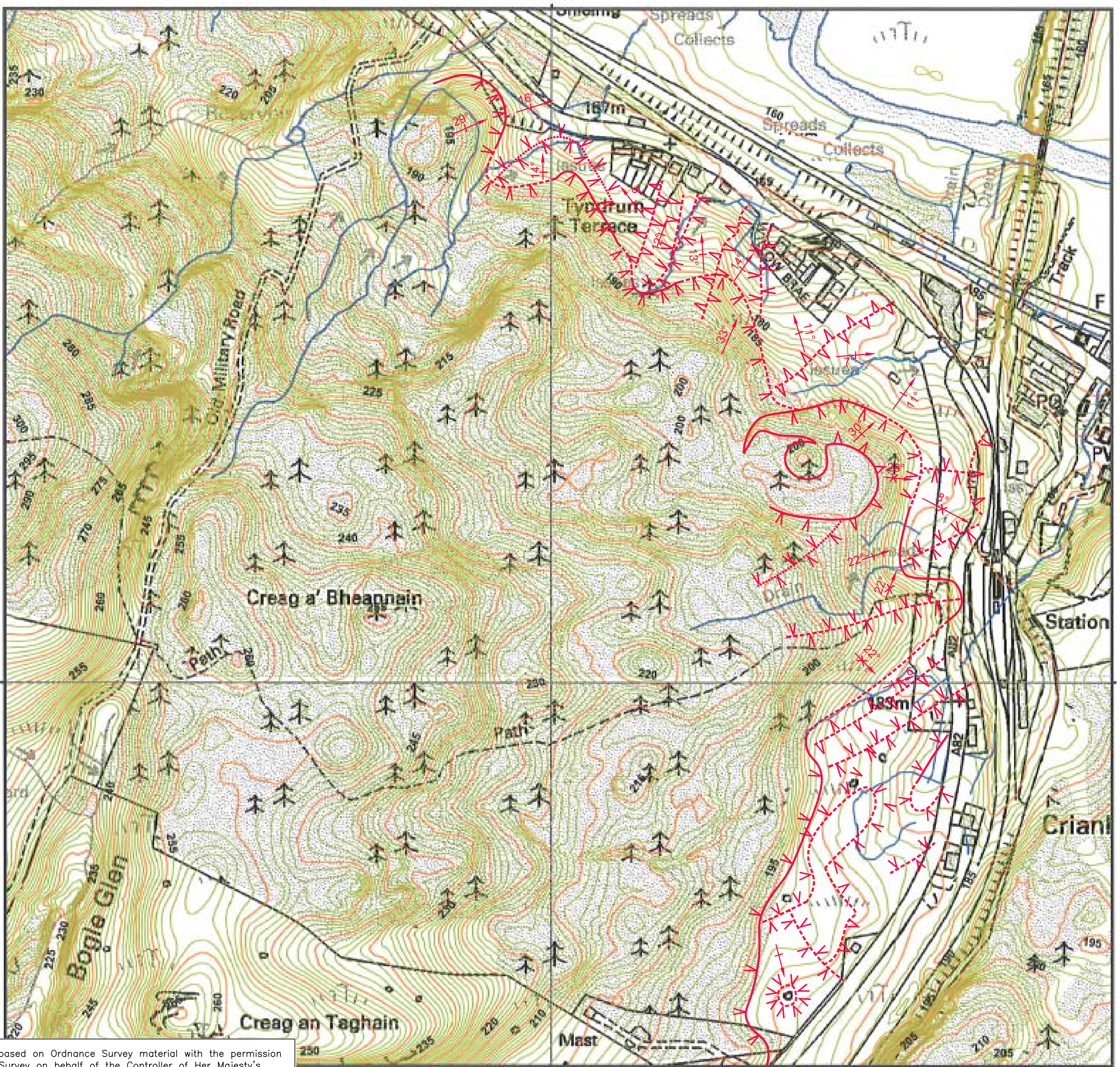

Drawing Path :
F:\4460\proj\P0000390600 Environment Multi-jo\A82 Crianlarich\CAD\P360600-Fig 2 rev 1 Geomorphology Map.dwg

Legend:-

MORPHOLOGICAL MAPPING SYMBOLS

- ANGULAR CONVEX BREAK OF SLOPE
- ANGULAR CONCAVE BREAK OF SLOPE
- SMOOTHLY CONVEX CHANGE OF SLOPE
- SMOOTHLY CONVEX CHANGE OF SLOPE
- 6° ANGLE OF SLOPE (DEGREES)
- CLIFFS (BEDROCK 40° OR MORE)
- BREAKS IN SLOPE
- CHANGES IN SLOPE

CONVEX AND CONCAVE TOO CLOSE TOGETHER TO ALLOW THE USE OF SEPARATE SYMBOLS

- CONVEX SLOPE UNIT
- CONCAVE SLOPE UNIT

Notes:-

No.	Date	Revision	By	Chk
1	July. 08	Final Issue	IBA	AH
0	June. 08	First Issue	IBA	AH

Drawn:	Checked:	Approved:	Date:
IBA	HC	AH	30.06.2008

Client / Project

Transport Scotland
Trunk Road Infrastructure
& Professional Services

TRANSPORT SCOTLAND

The A82 Trunk Road (Crianlarich Bypass)
Peat Landslide Hazard and Risk Assessment

Title

Figure 2:
Geomorphology Map
Date Source: Scottish Executive

Drawing Status

Final

File Ref : P00000346600	Drawing No : 346600-Fig 2	
Original Size: 420x297 - A3	Scale : NTS	Rev : 1

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