APPENDIX 7.1

DETAILED GEOLOGICAL ASSESSMENT REPORT

Report prepared for:

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Geological Assessment - Detailed

This report is aimed at customers and clients carrying out preliminary site assessments, who require a detailed assessment of the geology, hydrogeology and any geological hazards around the site.

The report, prepared by BGS geologists, is based on analysis of records and maps held in the National Geoscience Data Centre (NGDC), and includes descriptions of rock types, natural subsidence hazards and mining & quarrying hazard if present. It also contains geological map extracts taken from the BGS Digital Geological Map of Great Britain at the 1:50,000 scale (DiGMapGB-50) and a listing of the key geoscience data sets held in the NGDC for the area around the site. The report also considers the detailed hydrogeology of the site as a whole.

The report deals separately with each of the three proposed bypass routes indicated on the layout plan provided, namely the Crianlarich Western, Southern and Northern Bypasses. Some elements of the description of the geology and hydrogeology have, where appropriate, been combined for the site as a whole. The digital geological maps, which cover the whole area of study, show separately the two main layers of geology that have been mapped – **superficial deposits** and **bedrock**. The geological survey data currently available was originally published as the 'one inch' geological map in 1900 (Sheet 46 – Balquhidder). That information has been augmented here with new field observations made during resurvey of the area in 2003-06. These new data relate principally to the superficial deposits. Data derived from archive records of site investigation pitting and drilling between 1978 and 2005 are incorporated as appropriate.

More information on DiGMapGB-50 and how the various rock layers are classified can be found on the BGS website (www.bgs.ac.uk), under the DiGMap and BGS Rock Classification Scheme areas. Further descriptions of the rocks listed in the map keys can also be obtained by searching against the Computer Code on the *BGS Lexicon of named Rock Units*, which is also on the BGS Website at by following the 'GeoData' link. If in doubt, please contact BGS enquiries.

The geological formations are listed broadly in order of age in the map keys (youngest first) but only to the formation level (a formation is a package of related rocks). Within formations, please be aware that individual members may not be ordered by age. Note that for some parts of the site, the latest available records are quite historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described. Section 5 contains a list of the geological data available for this area.

Client's Reference: 115799

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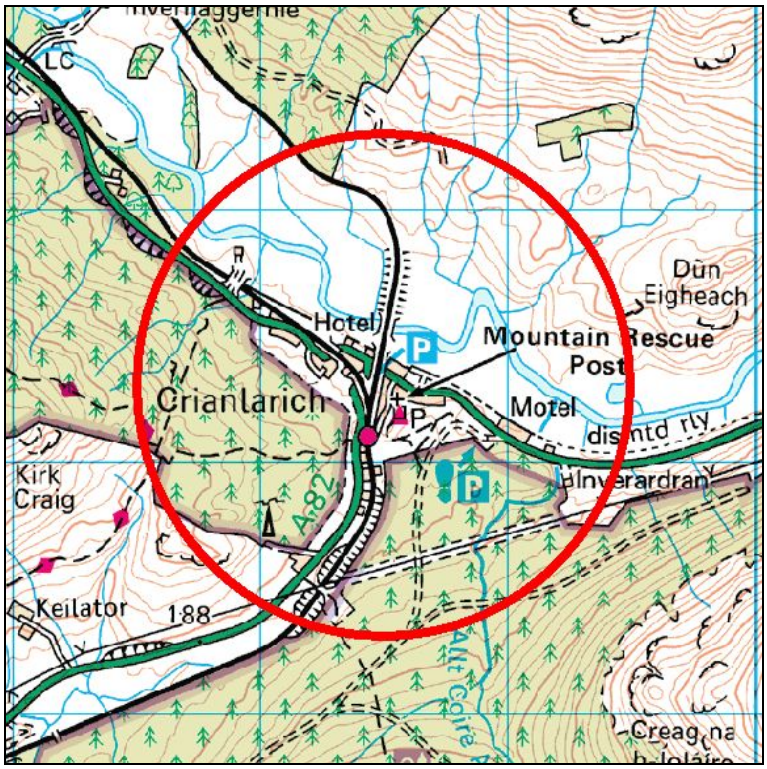
Section 1: Location and extent of report area

Area centred at: *238500,725300*
Radius of site area: *1000 metres*

The assessment in Sections 2, 3 and 4 is based upon the clients submitted a site plan. This figure shows the general location centred on Crianlarich village.



Scale: 1:30000 (1cm = 300m)

SITE LOCATION

Figure 1. General location

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Section 2: Description of the Geology & Hydrogeology for the site

This section describes the geological relationships applicable in the immediate vicinity of Crianlarich, with particular focus on the three proposed bypass routes indicated on the site plan submitted by the client. The relationship between deposits is shown in Figure 2 (see Section 3 below). The hydrogeological assessment is for the site as a whole.

2.1 Western bypass

2.1.1 Geomorphology

The proposed western route flanks the lower slopes northeast of Kirk Craig and Creag a' Bheannain, contouring around the hill from [NN 382 246] in the south to [NN 378 257] at its northern end. At its highest point the proposed route is c. 20 m higher than the present A82(T). Hillslopes immediately adjacent to, and continuing to the west of the route, are moundy up to *c.* 260 m O.D. (average gradient 1:11), rising more abruptly above to the summit of Kirk Craig (390 m O.D., gradient 1:6). Mounds on the lower slopes are often steep-sided and up to 10 m high, with intervening hollows and basins. East of the route smoother slopes descend to the present railway line at *c.* 180 – 190 m O.D.

Rockfall and landsliding from the upper slopes is possible but considered unlikely, the forestry plantations providing an effective buffer. Small failures of the superficial deposits forming the mounds may occur, but would be relatively isolated and limited in extent. Debris flows resulting from intense rainfall are possible, and would be channelled through the hollows between mounds. Several big surface channels currently exist along this route, intersecting the proposed road at approximately [NN 3788 2566], [NN 3800 2554], [NN 3812 2540], [NN 3824 2530], [NN 3834 2512], [NN 3835 2500], [NN 3832 2484] and [NN 3828 2474].

2.1.2 Artificial Ground

Artificial ground (made / worked / disturbed) is thought to be limited in this area, predominantly occurring in the immediate vicinity of the present A82(T). Typically, made ground will be less than 3 m thick, unless forming significant embankments.

2.1.3 Superficial geology

Superficial (unconsolidated) deposits overlie much of the bedrock and where absent, bedrock is exposed at the surface. Small (1 – 10 m) exposures of rock may be present throughout the area and are not necessarily shown on the map in Figure 5. A full description of the typical bedrock lithologies present in this area can be found in the 'Bedrock geology' section of this report.

FACIES 1: GLACIAL MORAINE DEPOSITS

Much of this proposed route is underlain by mounded deposits of glacial moraine. These landforms are heterogeneous, exhibiting highly variable composition, structure, degree of sorting, and compaction. They chiefly comprise a matrix of coarse to medium sand, with some fine sand and silt. The matrix hosts gravel (in bedded or massive units, or as isolated clasts), and boulders. Within these deposits, discrete beds of gravel and sand, and laminae of silt and clay, are common. These beds and laminae may not be laterally extensive, and may form localised 'pods'.

The upper *c.* 1 m of the deposit may be variably well-stained with iron and manganese oxides, and may exhibit hard 'pans' where these oxides have cemented the sandy matrix. In general, deposits with a coarser matrix tend to be relatively friable and poorly consolidated, whereas a finer-grained matrix produces a considerably firmer, more cohesive unit. There is thought to be little risk of compressibility associated with these deposits. Running sand may occur locally, but is likely to be restricted to pods or lenses no larger than decimeter-scale thickness and metre-scale lateral extent.

The mounded nature of the deposits gives rise to intervening hollows which formerly focussed and preferentially enabled accumulation of water-redeposited sand, silt and clay. These

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accumulations may be as much as several tens of metres across and up to 10 m thick. In most cases, however, they will be less than 5 m thick.

In many cases, morainic deposits are thought to overlie or grade downward into more consolidated diamicton of similar composition, but generally lacking in large boulders. This firm, cohesive, deposit – till – is assumed to form the basal substrate in much of the area (Figure 1), despite it not being commonly exposed. The deposit is typically pale yellow-brown to grey in colour, has a silt and fine sand-dominated matrix, and hosts cobble-grade subangular and subrounded clasts of local metasedimentary lithologies. Sand and gravel layers and pods are rarely seen, but may occur at any depth. They are likely to be laterally discontinuous.

FACIES 2: RIVER TERRACE DEPOSITS
This facies is largely absent in this area, with the exception of the ground immediately north of the northernmost point of this route. The description provided under the northern bypass route applies equally here and is not repeated.

FACIES 3: PEAT
Much of the ground is covered to some extent by peat. The thickness of this accumulation is typically < 1 m on the surface of individual moraines, but may be considerably thicker in the intervening hollows, for example around [NN 3812 2486] and [NN 3836 2512]. Peat is highly compressible and may hold large volumes of water. On sloping ground, saturated peat may be prone to 'bog bursts' under extreme rainfall conditions.

FACIES 4: GLACIOLACUSTRINE CLAY, SILT AND SAND
Some of the deeper channels along the western route may accommodate accumulations of bedded silt and sand up to 3 m thick, as for example at [NN 3822 2536]. These deposits are typically stratified, and may exhibit bedding or lamination within individual units. The sediments are most likely derived from reworking of the morainic material immediately post-deposition, and reflect settling-out in ephemeral ponds. Consequently their extent and thickness are likely to be highly variable. Whilst typically more compacted than Facies 2 sediments, there may nonetheless be some possibility of running sand in Facies 4 deposits. The likelihood of shrink-swell hazards associated with clay in these deposits in not known, but should be considered.

2.1.4 Depth to Rockhead

The previous site investigation records indicate that the depth to rockhead is variable but mostly in the range of 2 to 5 m. Depth to bedrock is likely to be greater, and may exceed 6 to 9 m in the vicinity of the surface channel features referred to in Section 2.1.1. above. Note that bedrock lies within 1 – 2 m of the surface in the vicinity of the proposed roundabout at the northern end of this route.

2.1.5 Bedrock Geology

Bedrock is most likely composed of schistose semipelite to psammite with more massive layers of psammite developed locally. The semipelite comprises quartz, muscovite, biotite +/- chlorite schist. Garnet may be abundant locally, as porphyroblasts 1 –2 mm in diameter. More psammitic rocks comprise quartz and subsidiary feldspar, muscovite and biotite. Individual layers (beds) are likely to be developed on a scale of a few tens of cm, with thicker units up to 1 m or so. Schistose pelite (muscovite, biotite-rich) may occur locally as discrete strongly foliated layers on a decimetre to metre scale. The degree of weathering is likely to be variable depending upon the degree of sub-glacial erosion. Records indicate more extensive weathering may be present within the uppermost metre or so of bedrock.

The inclination of the compositional layering is likely to be steep to sub-vertical (>50 - 60°), dipping typically either to the northwest or southeast. The tectonic fabric (schistosity) will be broadly parallel to the compositional layering. The more schistose layers are likely to be folded at a centimetre to decimeter scale.

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White quartz veins are likely to be present at a variety of scale from centimetre-scale lenticles developed along the schistosity to larger (decimeter wide?) cross-cutting veins.

Jointing will be commonly developed, perhaps locally intense. Drilling and pitting suggests that sub-horizontal and moderate to steep-dipping sets are present, the latter dipping at 40° to 60°. Joints may be coated with hematite, quartz or calcite. The orientation of these steeper-dipping joints is not recorded but may be broadly parallel to the NE-SW trend of the major faults in the region. There is no record of faulting or crush in the available investigation reports and no major fault is known to intersect the proposed bypass site.

2.2 Southern bypass

2.2.1 Geomorphology

The proposed southern route runs approximately due west from the A85(T) around [NN 3924 2500] to [NN 394 250] where it joins the present A82(T). A spur connects the proposed route back to the existing A85(T) at [NN 388 253]. The route bisects an area of moundy moraine deposits, which on the northern side are incised by the terrace of the River Fillan 300 – 500 m from the route. The southern aspect is dominated by hummocky slopes (gradient 1:10) that grade into smoother but steeper slopes (gradient 1:7) above the Allt Coire Ardrain.

Landslides and mass-flow events from adjacent slopes are possible, particularly where unconsolidated deposits are saturated for prolonged periods, or very intensely, by heavy rain. However, the irregular moundy lower slopes are likely to act as an effective buffer between the steeper, upper, slopes and the proposed route.

2.2.2 Artificial Ground

Artificial ground (made / worked / disturbed) is thought to be limited in this area, predominantly occurring in the immediate vicinity of the present A85(T) and A82(T), and in association with the railway workings around Crianlarich station. Typically, made ground will be less than 3 m thick, unless forming significant embankments.

2.2.3 Superficial geology

Superficial (unconsolidated) deposits overlie much of the bedrock and where absent, bedrock is exposed at the surface. Small (1 – 10 m) exposures of rock may be present throughout the area and are not necessarily shown on the map in Figure 5.

FACIES 1: GLACIAL MORAINE DEPOSITS

The majority of the ground underlying and immediately adjacent to the proposed southern bypass route is composed of morainic deposits. The general description provided above for the proposed western bypass route applies equally here and is not repeated in full. At [NN 3892 2505] a 5 m high exposure in one of the moraine mounds reveals a variably well-consolidated sandy matrix diamicton with poorly-sorted gravelly sand beds. Interstitial cobbles are typically subangular to subrounded in shape, up to 0.4 m in size, and of locally metasedimentary lithologies (psammite and semi-pelite). One or two larger boulders are also present.

FACIES 2: RIVER TERRACE DEPOSITS

This facies is largely absent in this area, with the exception of the ground immediately north of the easternmost point of this route. The description provided under the northern bypass route applies equally here and is not repeated.

FACIES 3: PEAT

Much of the ground is covered to some extent by peat. The thickness of this accumulation is typically < 1 m on the surface of individual moraines, but may be considerably thicker in the intervening hollows. Peat probe and trial pit investigations proved peat thicknesses of the order 5 – 10 m around [NN 386 250], generally becoming more highly compacted with depth. Peat is highly compressible and may hold large volumes of water. On sloping ground, saturated peat

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may be prone to 'bog bursts' under extreme rainfall conditions.

FACIES 4: GLACIOLACUSTRINE CLAY, SILT AND SAND
Some of the deeper channels between mounds in this area may accommodate accumulations of bedded silt and sand. Such sediments are known to occur to a depth of *c.* 3 m around [NN 3885 2520]. These deposits are typically stratified, and may exhibit bedding or lamination within individual units. The sediments are most likely derived from reworking of the morainic material immediately post-deposition, and reflect settling-out in ephemeral ponds. Consequently their extent and thickness are likely to be highly variable. Whilst typically more compacted than Facies 2 sediments, there may nonetheless be some possibility of running sand in Facies 4 deposits. The likelihood of shrink-swell hazards associated with clay in these deposits in not known, but should be considered.

2.2.4 Depth to bedrock
The previous site investigation records indicate that the depth to rockhead is more variable along the proposed southern route than on the western route. From a depth around 3 to 4 m at the western end of the route, depth to rockhead increases sharply south of the railway station. Records indicate that bedrock is only encountered at a depth of 10 to 12 m on either side of the railway tracks. East of the railway around [NN 386 251], depth to bedrock decreases again and is mostly in the range of 2 to 5 m. Farther east towards the A85(T), depth to bedrock is likely to increase to something in the region of 6 to 8 m but may locally be a little as 2 m. Records indicate that depth to bedrock along the spur connecting with the eastern access to Crainlarich would be in excess of 7 to 8 m.

2.2.5 Bedrock Geology
Bedrock is most likely composed of schistose semipelite to psammite with more massive layers of psammite developed locally. The rock type description provided above for the western bypass route is applies equally here and is not repeated in full.

The inclination of the compositional layering is likely to be steep to sub-vertical (>50 - 60°), dipping typically either to the northwest or southeast. The effects of folding are evident around [NN 386251] in dips to the northeast recorded in trial pitting. The tectonic fabric (schistosity) will be broadly parallel to the compositional layering. The more schistose layers are likely to be folded at a centimetre to decimeter scale. The possibility that steep northwest dips will occur in bedrock layers along this route should be considered carefully for reasons of slope stability.

White quartz veins are likely to be present at a variety of scale from centimetre-scale lenticles developed along the schistosity to larger (decimeter wide?) cross-cutting veins.

Jointing will be commonly developed, perhaps locally intense. Drilling and pitting suggests that subhorizontal and moderate to steep-dipping sets are present, the latter dipping at 40° to 60°. Joints may be coated with hematite, quartz or calcite. The orientation of these steeper-dipping joints is not recorded but may be broadly parallel to the NE-SW trend of the major faults in the region. There is no record of faulting or crush in the available investigation reports and no major fault is known to intersect the proposed bypass site.

2.3 Northern bypass

2.3.1 Geomorphology
The northern route follows Strath Fillan northwestward from around [NN 390 252] to near [NN 378 257]. The proposed route descends to the flat river terrace of the southeastward-flowing River Fillan, continues *c.* 1 km along the terrace, and rises at its northwestern end to rejoin the present A82 (T). The proposed route is flanked immediately on its northeastern side by the present channel of the River Fillan, then its 200 – 300 m wide northeastern terrace, and then farther to the northeast by moundy slopes (average gradient 1:8) that continue above a marked

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break in slope at c. 220 m O.D. into steeper, boulder-strewn slopes (average gradient 1:4). The area to the southwest of the proposed route is the town of Crianlarich, from where moundy slopes rise to the southwest at a gradient of approximately 1:11.

The proposed route may be prone to flooding if exceptionally high water levels occur, although this is considered unlikely. Landslides and mass-flow events from southwestern slopes are possible, particularly where unconsolidated deposits are saturated for prolonged periods, or very intensely, by heavy rain. However, the moundy lower slopes are likely to act as an effective buffer between the steeper, upper, slopes and the proposed route.

2.3.2 Artificial Ground

Artificial ground (made / worked / disturbed) is thought to be limited in this area, predominantly occurring in the immediate vicinity of the present A85(T) and A82(T). Both current railway lines and the dismantled railway near the eastern end of this route will also be a focus of artificial ground. Typically, made ground will be less than 3 m thick, unless forming significant embankments.

2.3.3 Superficial Geology

Superficial (unconsolidated) deposits are likely to be continuous above bedrock. Small (1 – 10 m) exposures of rock may be present but will not be shown on the map. The proposed route effectively runs parallel to the mapped boundary between Glacial Moraine Deposits (Facies 1) and the River Terrace Deposits (Facies 2)

FACIES 1: GLACIAL MORAINE DEPOSITS

The start and end points of the proposed route are underlain by mounded deposits of glacial moraine. The general description of these deposits provided above for the western route applies equally here and is not repeated in full. At [NN 3892 2505] a 5 m high exposure in one of the moraine mounds reveals a variably well-consolidated sandy matrix diamicton with poorly-sorted gravelly sand beds. Interstitial cobbles are typically subangular to subrounded in shape, up to 0.4 m in size, and of locally metasedimentary lithologies (psammite and semi-pelite). One or two larger boulders are also present.

FACIES 2: RIVER TERRACE DEPOSITS

The majority of the proposed route is underlain by the main terrace of the River Fillan. This terrace lies c. 5 m above the present level of the river (summer flow regime). Winter flow may raise the river level significantly. The terrace is essentially flat, but slopes very gently southeastward. No borehole records or field observations of the constituent material are available, however, river terraces such as this are typically composed of stratified gravel, sand and silt in variable proportions. The material is likely to be well-sorted and not particularly compacted. Abrupt changes in grain-size may occur both laterally and vertically as a result of channel-switching, overbank deposition, and fluvial reworking contemporaneous with terrace formation. Issues associated with running sand should be borne in mind in areas underlain by these deposits.

2.3.4 Depth to Bedrock

There is only limited data available for depth to rock head along this route. Those data indicate that bedrock is likely to be encountered at depths in excess of 7 – 9 m and are probably representative for much of the route. Bedrock may locally come closer to the surface at the extreme eastern and western ends of the proposed route, perhaps at 1 to 2 m depth.

2.3.5 Bedrock Geology

Based on the surrounding bedrock geology, bedrock along the northern proposed route is most likely composed of schistose semipelite to psammite with more massive layers of psammite developed locally. The rock type description provided above for the western and southern bypass routes applies equally here and is not repeated in full here. The inclination of units and presence or absence of jointing is likely to be similar also.

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2.4 Hydrogeology and groundwater vulnerability:

2.4.1 Aquifer descriptions

The deposits of glacial moraine are likely to be moderately permeable overall. However, due to their laterally discontinuous nature, the moraine is unlikely to permit significant flows of groundwater on a large scale. Surface & near surface runoff is likely to be high, due to the steep slopes of the valley sides and the fact that the moraine deposits are underlain by low permeability tills and bedrock. Where bands of silt and clay are present within moraines, perched water tables may occur within individual mounds. Overall, the water table within these deposits is likely to be within 5 m of the surface near the valley floor, while mounds on the valley sides are likely to be largely unsaturated during the summer months.

The river terrace deposits are likely to be moderately or highly permeable overall, allowing rapid infiltration and throughflow of groundwater. Rest water levels in any borehole drilled into these deposits are likely to be within a few metres of the surface throughout the year.

Although peat commonly contains large volumes of groundwater, it has a fairly low permeability and runoff is likely to be high.

The glaciolacustrine deposits in this area are likely to have a low permeability and to inhibit the flow of groundwater on a large scale. The water level in these deposits is likely to be within a few metres of the surface throughout the year and there is likely to be a high proportion of runoff.

Glacial till generally has a low permeability and is likely to inhibit the infiltration and throughflow of groundwater. Small seepages may occur in layers or lenses of sandy material within the deposits, however. We would expect the till to be largely saturated throughout the year.

The metamorphic bedrock of this part of Scotland has a low permeability overall, permitting groundwater flow only through fractures in the rock. These fractures tend to be more common in the top few tens of metres of the rock and occur with greater frequency in the valley floor than on hillslopes. The rest water level in a borehole drilled into the bedrock in this area is likely to be within 10 m of the surface on the valley sides and within 5 m of the surface in the valley floor.

2.4.2 Groundwater Quality

Although few data are available on the quality of groundwater in this area, we would expect groundwater in aquifers of this type to have low concentrations of most major elements. It is likely to be fairly soft, with a pH close to neutral and low concentrations of nitrate. The site lies out with any Nitrate Vulnerable Zones (NVZs).

2.4.3 Groundwater vulnerability

Groundwater beneath the site is shown as highly vulnerable on the Scottish Environment Protection Agency's Groundwater Vulnerability maps. These maps, which are not designed for site-specific investigations but indicate vulnerability on a large scale, highlight the areas where exposed bedrock has been mapped (see figure 5). This is because, despite its limited ability to store large volumes of groundwater, the fractures within the bedrock allow the rapid transport of contaminants to the water table, with little opportunity for attenuation to occur. This, in conjunction with a fairly thin or absent overlying superficial cover, makes the bedrock aquifer highly vulnerable to contamination.

The river terrace deposits are also likely to be highly vulnerable to contamination, due in part to their high overall permeability and shallow water tables. Their situation at the base of the valley makes them further vulnerable to contamination from surface runoff and groundwater throughflow from the valley sides.

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Individual sites will always require more detailed assessments to determine the specific impact on groundwater resources. The maps only represent conditions at the surface and where the soil and/or underlying formations have been disturbed or removed, the vulnerability class may have been changed and site specific data will be required.

2.5 Natural Land Gas

Available records indicate encountering gas from bedrock, mining or peat would be unlikely.

2.6 Mining

There are no records of shallow mining in the area.

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Section 3: Schematic Geological Cross-Section of the Site

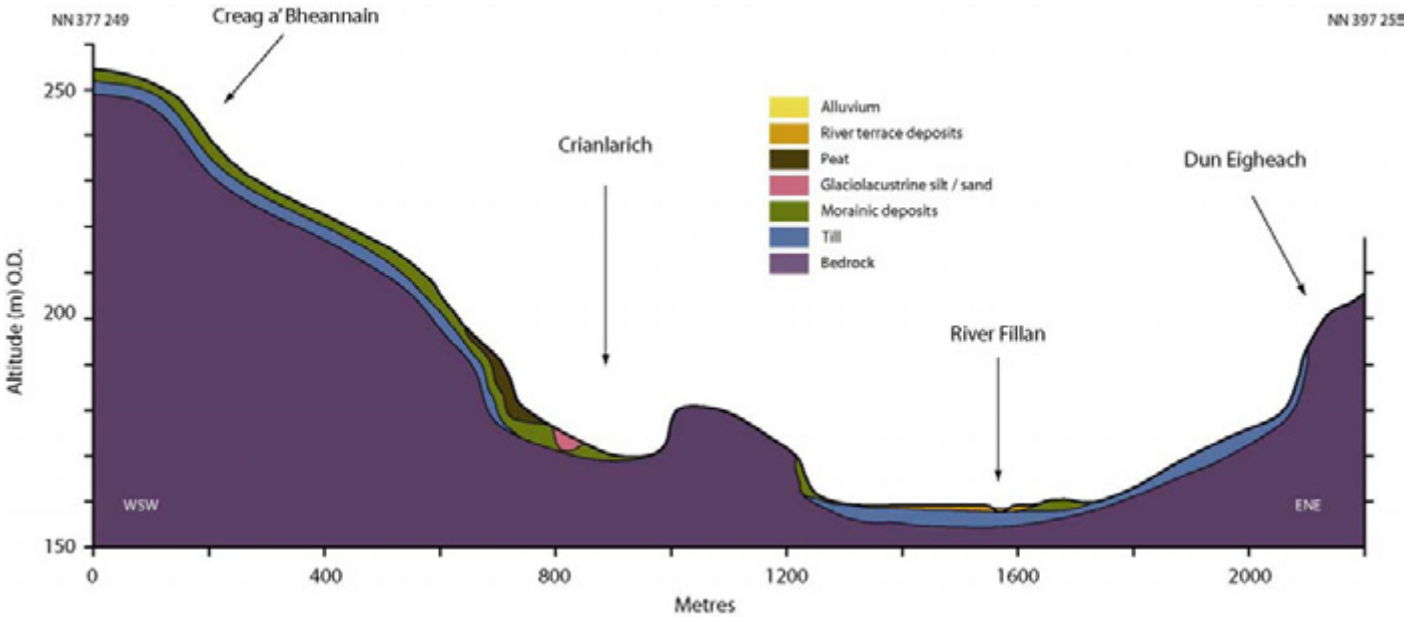

Figure 2. Schematic Geological Cross-Section of the Site

This sketch represents an interpretation of the geometrical relationships of the main rock units described in the text. Exaggeration of the vertical scale relative to the horizontal allows depiction of the various superficial deposits.

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Section 4: Geological maps

Extracts of geology maps around your site are provided in this section, taken from the BGS Digital Geological Map of Great Britain at the 1:50,000 scale (DiGMapGB-50). The first four maps show separately the four main layers of geology that may be present in an area – **artificial (man-made) deposits**, **landslip deposits**, **superficial deposits** and **bedrock**. The fifth 'combined geology' map shows all four rock layers superimposed on the same map, to show the rocks that occur at the surface just beneath the soil.

More information on DiGMapGB-50 and how the various rock layers are classified can be found on the BGS website (www.bgs.ac.uk), under the DiGMap and BGS Rock Classification Scheme areas. Further descriptions of the rocks listed in the map keys can also be obtained by searching against the Computer Code on the *BGS Lexicon of named Rock Units*, which is also on the BGS Website at by following the 'GeoData' link. The computer codes are labelled on the maps to try and help in their interpretation (with a dot at the bottom left hand corner of each label). However, please treat this with caution in areas of complex geology, where some of the labels may overlap several geological formations. If in doubt, please contact BGS enquiries.

The geological formations are listed broadly in order of age in the map keys (youngest first) but only to the formation level (a formation is a package of related rocks). Within formations, please be aware that individual members may not be ordered by age.

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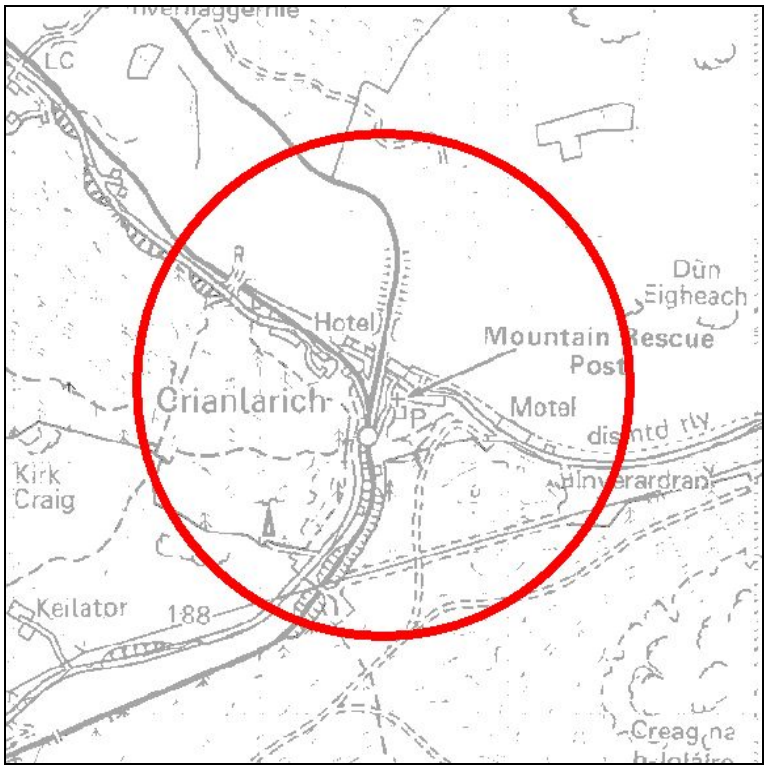
4.1 Artificial deposits

These include deposits moved and disturbed by man.



Scale: 1:30000 (1cm = 300m)

SITE LOCATION

Key to Artificial deposits:

No deposits are mapped in the search area

Figure 3. Artificial Deposits

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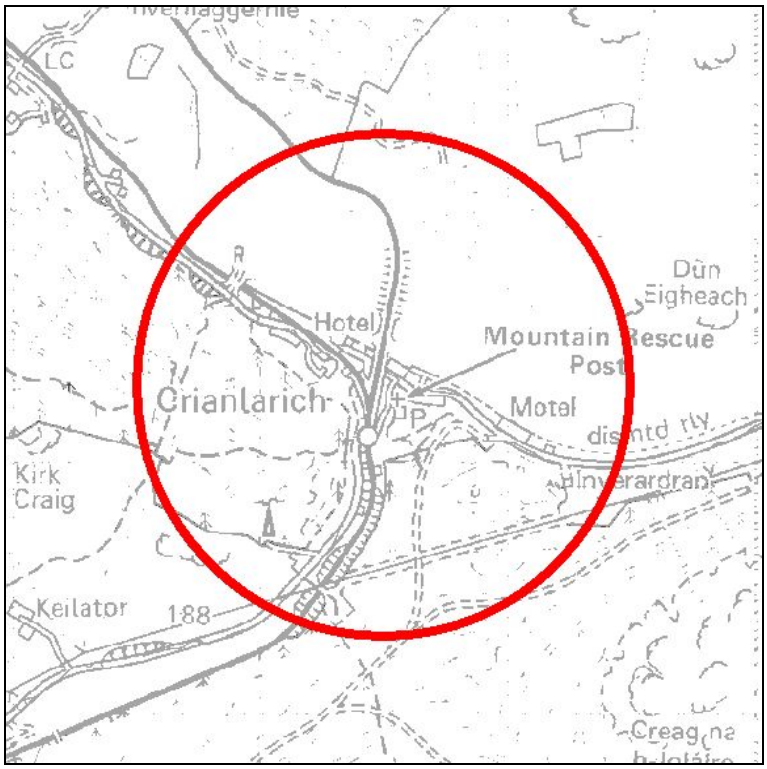
4.2 Landslip deposits

These include natural deposits formed by sliding and mass-movement of soils and rocks on hill slopes (an alternative term for Landslip deposits is 'Mass Movement Deposits')



Scale: 1:30000 (1cm = 300m)

SITE LOCATION

Key to Landslip deposits:

No deposits are mapped in the search area

Figure 4. Landslip Deposits

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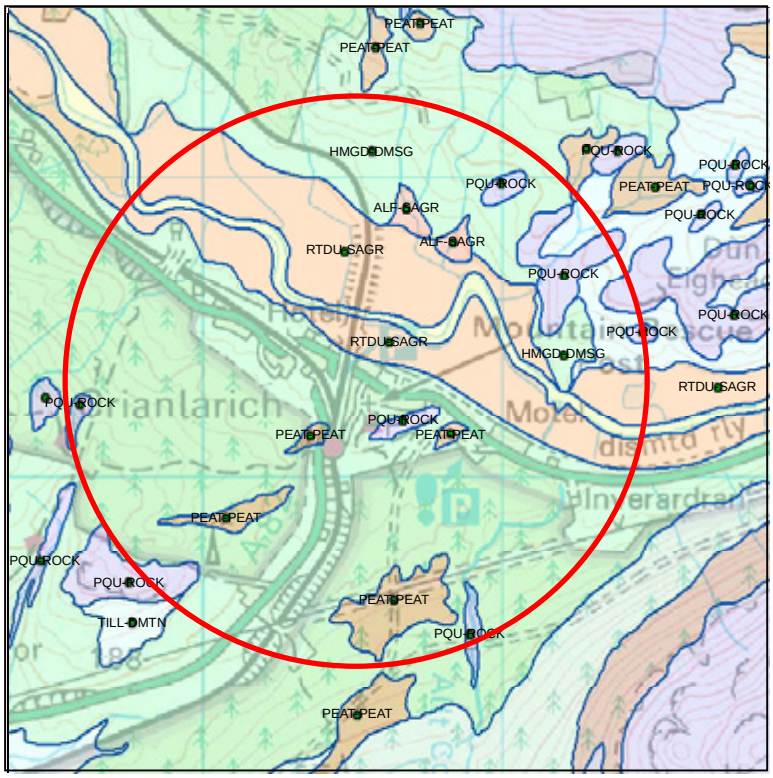
4.3 Superficial deposits

These include fairly recent geological deposits, such as river sands and gravels, or glacial deposits, which lie on the bedrock in many areas (an alternative term for Superficial deposits is 'Drift Deposits')



Scale: 1:25000 (1cm = 250m)

SITE LOCATION

Key to Superficial deposits:

Computer Code	Rock name	Rock type
PQU-ROCK	PRE-QUATERNARY ROCKS (UNDIFFERENTIATED)	BEDROCK
PEAT-PEAT	PEAT	PEAT
TILL-DTMN	TILL	DIAMICTON
RTDU-SAGR	RIVER TERRACE DEPOSITS (UNDIFFERENTIATED)	SAND & GRAVEL
ALF-SAGR	ALLUVIAL FAN DEPOSITS	SAND & GRAVEL
HMGD-DMSG	HUMMOCKY (MOUNDY) GLACIAL DEPOSITS	DIAMICTON, SAND AND GRAVEL

Figure 5. Superficial Deposits based upon the recent revision mapping.

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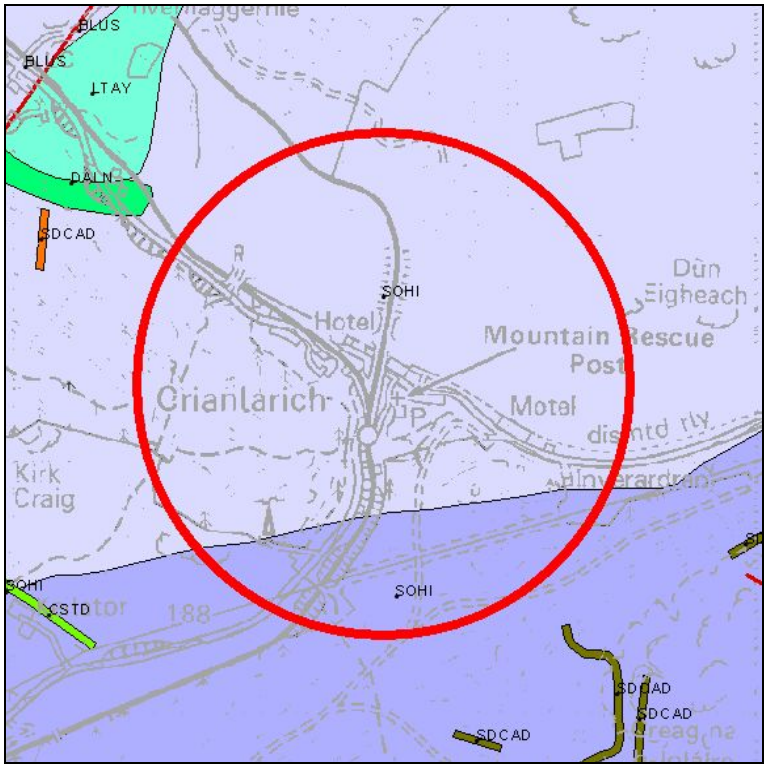
4.4 Bedrock

Bedrock forms the ground underlying the whole of an area, upon which the other geological layers listed above may lie (an alternative term for Bedrock is 'Solid Geology')



Scale: 1:30000 (1cm = 300m)

SITE LOCATION

Fault

Coal, ironstone or other mineral vein

Note: Faults and Coals, ironstone & mineral veins are shown for illustration and to aid interpretation of the map. Not all such features are shown and their absence on the map face does not necessarily mean that none are present

Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	CSTD	CENTRAL SCOTLAND LATE CARBONIFEROUS THOLEIITIC DYKE SWARM	BASALT AND DOLERITE
	SDCAD	NORTH BRITAIN SILURO-DEVONIAN CALC-ALKALINE DYKE SUITE	LAMPROPHYRE
	DALN	DALRADIAN SUPERGROUP	METAGABBRO AND METADOLERITE
	LTAY	LOCH TAY LIMESTONE FORMATION	METALIMESTONE
	SOHI	SOUTHERN HIGHLAND GROUP	SEMIPELITE
	SOHI	SOUTHERN HIGHLAND GROUP	SEMIPELITE AND PSAMMITE

Figure 6. Bedrock Geology

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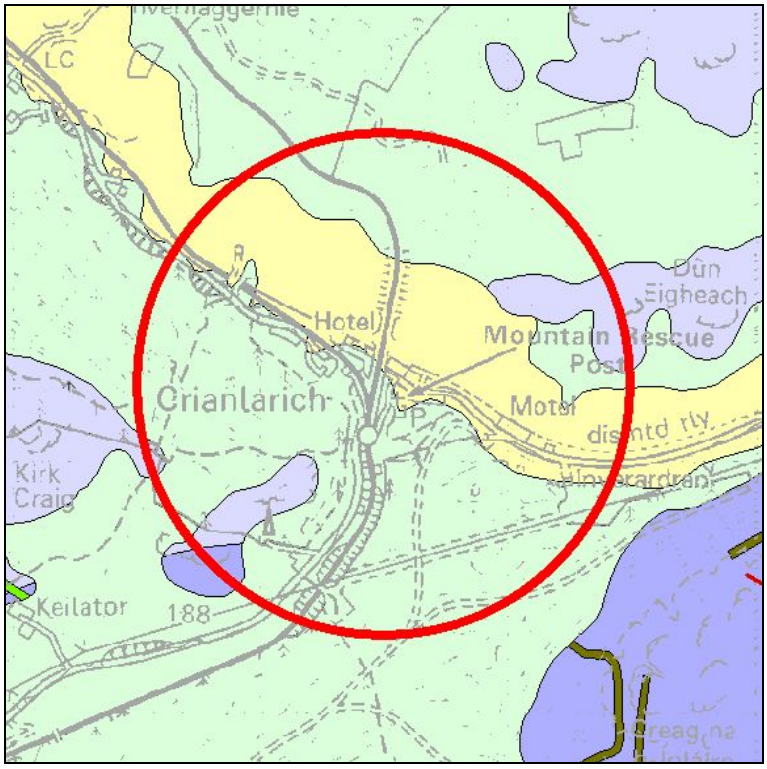
4.5 Combined 'Surface Geology' Map

Please note that this map shows a combination of the existing digital record for all four rock layers but does not include the modern revision of the superficial geology (see Fig. 5). The map gives a generalised impression of the superficial geology from pre-existing survey data.



Scale: 1:30000 (1cm = 300m)

SITE LOCATION

Please see the Keys to the Artificial, Landslip, Superficial and Bedrock geology maps.

Figure 7. Combined 'Surface Geology' Map

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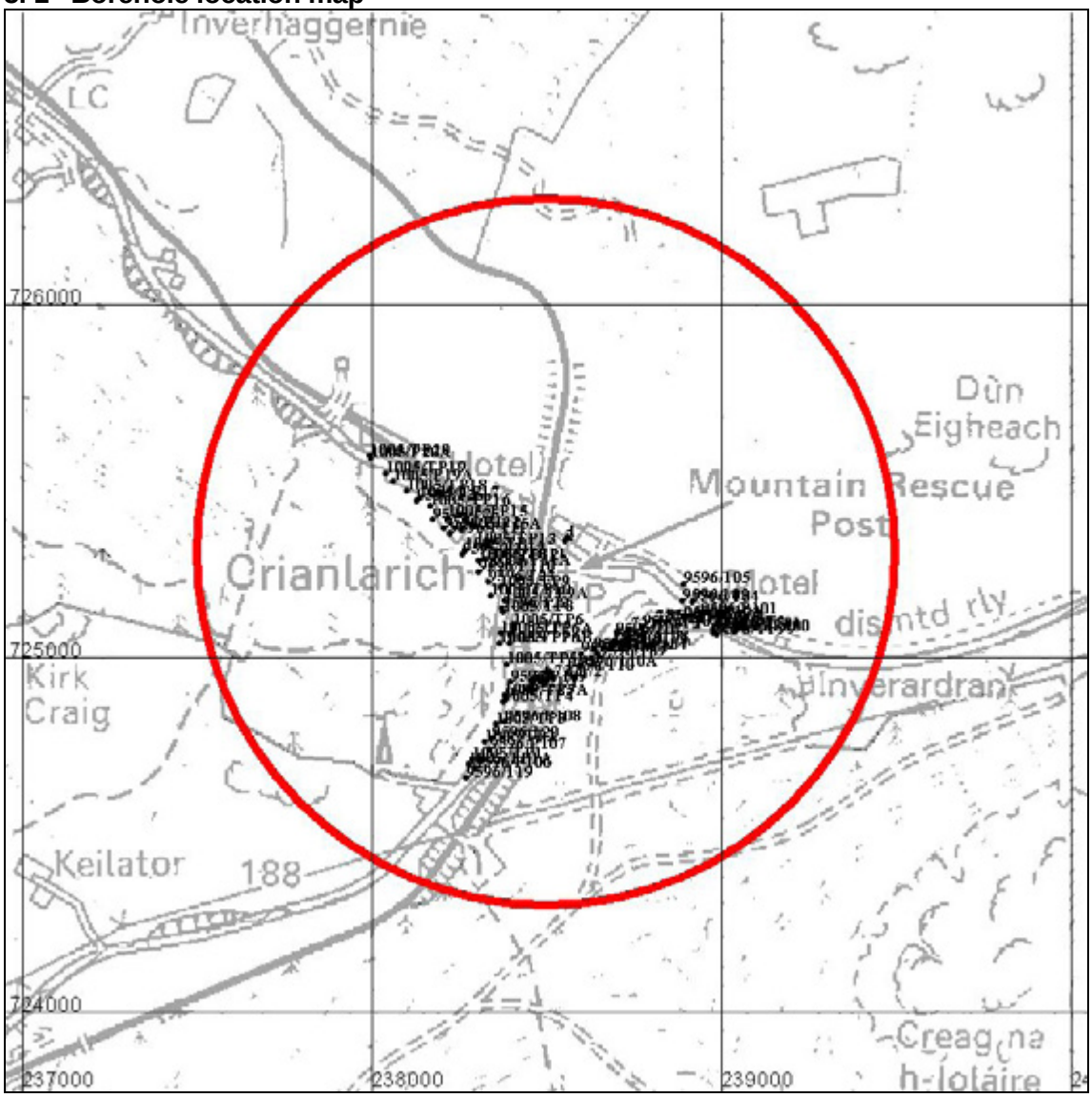
Section 5: List of geological data available around the site

This section lists the principal data sets held in the National Geoscience Records Centre that are relevant to the site. Descriptions of the data sets and how to obtain copies of records from them are given in Sections 7 and 8. Users with access to computing facilities can make their own index searches using the BGS Internet Geoscience Data Index, accessible through the BGS website at www.bgs.ac.uk

5. 1 Borehole location map



Scale: 1:20000 (1cm = 200m)

Figure 8. Borehole Location Map

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5. 2 Borehole records

Total number of records: 85

The 'Office' column shows the office at which the records are held and from where copies can be obtained (see contact details later in the report). KW=Keyworth, MH & MW=Murchison House, WL=Wallingford, EX=Exeter

Regno	Grid_reference	Name	Length	Office	SIR
NN32NE1	NN 38560 25340	PROPOSED PUMPING STATION, CRIANLARICH BH.1	8.00	MH	21456
NN32NE2	NN 38550 25330	PROPOSED PUMPING STATION, CRIANLARICH BH.2	9.80	MH	21456
NN32NE1005/TP6	NN 38403 25088	A82 CRIANLARICH BYPASS TP6	2.00	MH	1005
NN32NE1005/TP7	NN 38368 25069	A82 CRIANLARICH BYPASS TP7	4.00	MH	1005
NN32NE1005/TP8	NN 38375 25128	A82 CRIANLARICH BYPASS TP8	4.00	MH	1005
NN32NE1005/TP9	NN 38366 25198	A82 CRIANLARICH BYPASS TP9	4.00	MH	1005
NN32NE1005/P11A	NN 38338 25260	A82 CRIANLARICH BYPASS TP11A	4.00	MH	1005
NN32NE1005/P15A	NN 38256 25362	A82 CRIANLARICH BYPASS TP15A	3.00	MH	1005
NN32NE1005/P19A	NN 38061 25500	A82 CRIANLARICH BYPASS TP19A	2.00	MH	1005
NN32NE1005/P20A	NN 37998 25564	A82 CRIANLARICH BYPASS TP20A	1.00	MH	1005
NN32NE1005/TP10	NN 38341 25174	A82 CRIANLARICH BYPASS TP10	2.00	MH	1005
NN32NE1005/TP11	NN 38327 25278	A82 CRIANLARICH BYPASS TP11	3.00	MH	1005
NN32NE1005/TP12	NN 38304 25272	A82 CRIANLARICH BYPASS TP12	2.00	MH	1005
NN32NE1005/TP13	NN 38298 25319	A82 CRIANLARICH BYPASS TP13	3.00	MH	1005
NN32NE1005/TP14	NN 38266 25304	A82 CRIANLARICH BYPASS TP14	3.00	MH	1005
NN32NE1005/TP15	NN 38215 25395	A82 CRIANLARICH BYPASS TP15	2.00	MH	1005
NN32NE1005/TP16	NN 38166 25429	A82 CRIANLARICH BYPASS TP16	1.00	MH	1005
NN32NE1005/TP17	NN 38134 25449	A82 CRIANLARICH BYPASS TP17	2.00	MH	1005
NN32NE1005/TP18	NN 38100 25472	A82 CRIANLARICH BYPASS TP18	2.00	MH	1005
NN32NE1005/TP19	NN 38039 25522	A82 CRIANLARICH BYPASS TP19	3.00	MH	1005
NN32NE1005/TP20	NN 37994 25569	A82 CRIANLARICH BYPASS TP20	0.00	MH	1005
NN32NE1005/TP6A	NN 38392 25065	A82 CRIANLARICH BYPASS TP6A	0.00	MH	1005
NN32NE1005/TP6B	NN 38393 25039	A82 CRIANLARICH BYPASS TP6B	0.00	MH	1005
NN32NE1005/TP7A	NN 38364 25041	A82 CRIANLARICH BYPASS TP7A	3.00	MH	1005
NN32NE1005/TP9A	NN 38378 25162	A82 CRIANLARICH BYPASS TP9A	4.00	MH	1005
NN32NE7221/4	NN 38691 25048	A82/A85 CRIANLARICH BYPASS BH4	7.00	MH	7221
NN32NE7221/5	NN 38984 25094	A82/A85 CRIANLARICH BYPASS BH5	7.00	MH	7221
NN32NE7221/TP2	NN 38739 25078	A82/A85 CRIANLARICH BYPASS TP2	1.00	MH	7221
NN32NE7221/TP3	NN 38808 25100	A82/A85 CRIANLARICH BYPASS TP3	2.00	MH	7221
NN32NE7221/TP4	NN 38879 25093	A82/A85 CRIANLARICH BYPASS TP4	3.00	MH	7221
NN32NE7221/TT1	NN 38644 25014	A82/A85 CRIANLARICH BYPASS TT1	3.00	MH	7221
NN32NE7221/TT2	NN 38695 25036	A82/A85 CRIANLARICH BYPASS TT2	3.00	MH	7221
NN32NE7221/TT3	NN 38976 25081	A82/A85 CRIANLARICH BYPASS TT3	2.00	MH	7221
NN32NE9596/101	NN 38976 25070	A82/A85 CRIANLARICH BH.101	12.00	MH	9596
NN32NE9596/102	NN 38931 25099	A82/A85 CRIANLARICH BH.102	6.00	MH	9596
NN32NE9596/103	NN 38888 25161	A82/A85 CRIANLARICH BH.103	8.00	MH	9596
NN32NE9596/104	NN 38914 25158	A82/A85 CRIANLARICH BH.104	8.00	MH	9596
NN32NE9596/105	NN 38889 25208	A82/A85 CRIANLARICH BH.105	7.00	MH	9596
NN32NE9596/106	NN 38840 25102	A82/A85 CRIANLARICH BH.106	5.00	MH	9596
NN32NE9596/107	NN 38698 25066	A82/A85 CRIANLARICH BH.107	8.00	MH	9596
NN32NE9596/108	NN 38714 25044	A82/A85 CRIANLARICH BH.108	8.00	MH	9596
NN32NE9596/109	NN 38649 25000	A82/A85 CRIANLARICH BH.109	8.00	MH	9596
NN32NE9596/122	NN 38370 25139	A82/A85 CRIANLARICH BH.122	6.00	MH	9596
NN32NE9596/123	NN 38331 25214	A82/A85 CRIANLARICH BH.123	10.00	MH	9596
NN32NE9596/124	NN 38257 25290	A82/A85 CRIANLARICH BH.124	9.00	MH	9596
NN32NE9596/125	NN 38174 25389	A82/A85 CRIANLARICH BH.125	9.00	MH	9596
NN32NE9596/126	NN 38128 25442	A82/A85 CRIANLARICH BH.126	6.00	MH	9596
NN32NE9596/109A	NN 38632 25022	A82/A85 CRIANLARICH BH.109A	9.00	MH	9596
NN32NE9596/P100	NN 39033 25071	A82/A85 CRIANLARICH TP100	2.00	MH	9596
NN32NE9596/P101	NN 38940 25121	A82/A85 CRIANLARICH TP101	3.00	MH	9596
NN32NE9596/P102	NN 38889 25111	A82/A85 CRIANLARICH TP102	3.00	MH	9596
NN32NE9596/P103	NN 38775 25087	A82/A85 CRIANLARICH TP103	2.00	MH	9596
NN32NE9596/P104	NN 38684 25023	A82/A85 CRIANLARICH TP104	2.00	MH	9596
NN32NE9596/P105	NN 38597 25010	A82/A85 CRIANLARICH TP105	4.00	MH	9596
NN32NE9596/P110	NN 38305 25242	A82/A85 CRIANLARICH TP110	3.00	MH	9596
NN32NE9596/P111	NN 38222 25351	A82/A85 CRIANLARICH TP111	3.00	MH	9596
NN32NE9596/P112	NN 38207 25365	A82/A85 CRIANLARICH TP112	3.00	MH	9596

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Regno	Grid_reference	Name	Length	Office	SIR
NN32NE9596/T101	NN 39004 25079	A82/A85 CRIANLARICH BH.TT101	6.00	MH	9596
NN32NE9596/TP99	NN 38984 25064	A82/A85 CRIANLARICH TP99	2.00	MH	9596
NN32SE1	NN 38499 24934	A82/A85 CRIANLARICH 111	10.00	MH	9596
NN32SE2	NN 38485 24930	A82/A85 CRIANLARICH 113	21.00	MH	9596
NN32SE3	NN 38485 24934	A82/A85 CRIANLARICH 112	15.00	MH	9596
NN32SE4	NN 38486 24944	A82/A85 CRIANLARICH 114	16.00	MH	9596
NN32SE5	NN 38457 24930	A82/A85 CRIANLARICH 115	13.00	MH	9596
NN32SE6	NN 38457 24917	A82/A85 CRIANLARICH 116	20.00	MH	9596
NN32SE7	NN 38441 24911	A82/A85 CRIANLARICH 118	9.00	MH	9596
NN32SE8	NN 38455 24903	A82/A85 CRIANLARICH 117	16.00	MH	9596
NN32SE9	NN 38383 24881	A82/A85 CRIANLARICH 121	9.00	MH	9596
NN32SE1005/TP1	NN 38288 24711	A82 CRIANLARICH BYPASS TP1	4.00	MH	1005
NN32SE1005/TP2	NN 38322 24762	A82 CRIANLARICH BYPASS TP2	3.00	MH	1005
NN32SE1005/TP3	NN 38355 24812	A82 CRIANLARICH BYPASS TP3	4.00	MH	1005
NN32SE1005/TP4	NN 38374 24874	A82 CRIANLARICH BYPASS TP4	4.00	MH	1005
NN32SE1005/TP5	NN 38387 24979	A82 CRIANLARICH BYPASS TP5	3.00	MH	1005
NN32SE1005/TP1A	NN 38277 24697	A82 CRIANLARICH BYPASS TP1A	3.00	MH	1005
NN32SE1005/TP5A	NN 38377 24893	A82 CRIANLARICH BYPASS TP5A	4.00	MH	1005
NN32SE7221/1	NN 38452 24913	A82/A85 CRIANLARICH BYPASS BH1	12.00	MH	7221
NN32SE7221/2	NN 38519 24943	A82/A85 CRIANLARICH BYPASS BH2	14.00	MH	7221
NN32SE9596/110	NN 38558 24961	A82/A85 CRIANLARICH BH.110	5.00	MH	9596
NN32SE9596/119	NN 38268 24658	A82/A85 CRIANLARICH BH.119	6.00	MH	9596
NN32SE9596/120	NN 38342 24772	A82/A85 CRIANLARICH BH.120	7.00	MH	9596
NN32SE9596/110A	NN 38592 24974	A82/A85 CRIANLARICH BH.110A	7.00	MH	9596
NN32SE9596/P106	NN 38294 24688	A82/A85 CRIANLARICH TP106	3.00	MH	9596
NN32SE9596/P107	NN 38337 24739	A82/A85 CRIANLARICH TP107	3.00	MH	9596
NN32SE9596/P108	NN 38377 24819	A82/A85 CRIANLARICH TP108	3.00	MH	9596
NN32SE9596/P109	NN 38395 24931	A82/A85 CRIANLARICH TP109	3.00	MH	9596

5.3 There are no records for Water Well Records in the selected area

5.4 There are no records for Boreholes with water level readings in the selected area

5.5 There are no records for Locations with aquifer properties in the selected area

5.6 Site investigation reports

Total number of records: 4

Number	Office	Title
1005	MH	CRIANLARICH-BY PASS
7221	MH	A82/A85 PROP CRIANLARICH BYPASS
9596	MH	A82/A85 CRIANLARICH BY-PASS
21456	MH	Pumping Station at Crianlarich

5. 7 County Series geological maps (1:10,560 scale)

Total number of records: 1

Map	Type	Published
Perth & Clackmannanshire90FS	C	

5.8 There are no records for Waste sites in the selected area

5.9 There are no records for Mining plans in the selected area

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Section 6: Descriptions of BGS databases

Note that this report is not a definitive listing of all data held in BGS.

Borehole Records and Water Wells

Records of boreholes, shafts and wells from all forms of drilling and site investigation work. Some 900,000 records dating back over 200 years and ranging from one to several thousand metres deep. Currently some 50,000 new records are being added to the collection each year.

A small percentage of the borehole records are held commercial-in-confidence for various reasons and cannot be released without the written permission of the originator. If any of the records you need are listed as confidential apply in the normal way. BGS Enquiry Service staff will release the data where this is possible or provide you with the information needed to contact the originator.

Where records are held in more than one office, the contents may differ. Enquiries principally requiring water related information should contact the Wallingford or Edinburgh office.

Water levels

These represent a subset of records within the National Well Record Archive of water wells and boreholes where there are either digital or analogue time series of water levels, or where available water level data span multiple years. Time series data are held for approximately 1500 boreholes distributed nationally. Other water level data is available where records have been inspected and digitised. Record's, are identified by the Well Registration number used for water wells (see above). Please contact our Wallingford office to discuss your specific requirements and to obtain costs.

Aquifer properties

These are locations where data on aquifer physical properties (transmissivity, specific yield, storage, porosity or hydraulic conductivity) are held. The data include raw data from field and laboratory investigations, and site-specific summaries of the data. Coverage is limited to aquifers in England and Wales. Records are identified by an aquifer property identifier, which should be quoted when ordering data. This data should be ordered separately, but will normally be provided and charged for as part of the relevant borehole records.

Site investigation reports

Additional laboratory and test data may be available in these reports, subject to any copyright and confidentiality conditions. The grid references used are based on an un-refined rectangle and therefore may not be applicable to a specific site. Borehole records in these reports will be individually referenced within the borehole records collection, described above.

Geological maps

- **National Grid maps (1:10,000 and 1:10560 scale) -** Since the 1960s the standard large-scale map for recording geological information has been the Ordnance Survey (OS) quarter sheet covering a 5km square area. The maps are supplied in different formats depending on their age and the method of reproduction used. Only the latest most up-to-date version is listed.

- **County Series map sheets (1:10,560 scale) -** Maps produced on OS County Series sheets between approximately 1860 and 1960. The list indicates distinct examples of maps from separate surveys or revisions. It is advisable to discuss your requirements before ordering or travelling to view these maps.

- **New Series medium scale maps (1:50,000 and 1:63360 scale)** - Maps at either scale covering the OS New Series one-inch map sheet areas used by BGS. Please note that the sheet numbering is not the same as used for current OS 1:50,000 topographic maps.

- **Old Series medium scale one-inch maps (1:63,360 scale) -** Early geological mapping covering the OS Old Series one-inch map sheet areas. Applies to England and Wales only.

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While there may be information relevant to your enquiry on older maps, you will generally want the latest edition, and National Grid maps will be preferred to County Series maps, and New Series to Old Series.

Memoirs

Explanatory sheet memoirs describing the geology of the areas covered by either the medium scale (1:50,000 and 1:63,360) map series.

Technical reports

The open file reports listed are mainly from the Onshore Geology Series. These include descriptions of the geology for the National Grid series geological sheets. Please note that the location details in the database are not yet complete so it is possible that not all the relevant reports available will be listed.

Waste sites

Listing of some 3500 waste sites for England and Wales identified by BGS as part of a survey carried out on behalf of the Department of the Environment in 1973. Later information is available from the Environment Agency.

Mine Plans

Plans of various types, principally relating to mining activity and including abandonment plans. For mine plans, the coverage is not comprehensive, but that for Scotland is the most complete. The search includes the collection of Plans of Abandoned Mines (Other than Coal & Oil Shale) for Scotland and the non-coal plans in the BGS Land Survey Plans collection, (mainly Scotland). Microfilm copies of the Plans of Abandoned Mines (Coal & Oil Shale) for Scotland and the Coal Authority's catalogues are available for consultation by prior appointment.

The mine plans listed for the rest of England and Wales (excluding SW England, which is not covered) include working copies, compilations and interpretations, which may be copyright or confidential and therefore not be available for purchase. The general nature of some of the plans means that they may not be applicable to a specific site. However, the presence of mining data could indicate that further specialist advice or interpretation is required. Large-scale plans produced for site investigations or other purposes are also included for completeness.

Section 7: How to access or inspect data

Borehole Records – *contact BGS Enquiry Service (see end of section)*

Copies of borehole records can be supplied (order form enclosed) at the flat rate of £13 (+VAT) per log with a minimum charge £26 (+VAT). Normal first class postage within the UK is included. Next day recorded delivery or express parcel dispatch is available on request and charged at cost. Copies of documents can be forwarded by facsimile transmission at an additional charge of £0.50 (+VAT) per A4 sheet. Records with additional detailed geological information derived from BGS examination of borehole material may be charged at the current 'value-added' rate. If you have a need for data with particular geological characteristics, then please contact the enquiries office to discuss your requirements (additional charges may apply).

Alternatively you can make an appointment to visit the relevant enquiry office and examine the records yourself. The Commercial User Ticket (see below) covers inspection of the borehole logs and includes access to a set of relevant documents for one unit area (typically a 5 km x 5 km area). A further charge of £19 (+ VAT) is due for each additional set examined. Data can be freely extracted from the records but any copies requested will be charged as above.

Water wells – *contact BGS Enquiry Service*

Copies of records can be supplied (order form enclosed) at the flat rate of £13 (+VAT) per log with a minimum charge £26 (+VAT). Normal first class postage within the UK is included. Next day recorded delivery or express parcel dispatch is available on request and charged at cost. Copies of documents can be forwarded by facsimile transmission at an additional charge of £0.50 (+VAT) per A4 sheet.

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If you have a need for data with particular hydrogeological characteristics, then please contact the relevant enquiries office (England and Wales =Wallingford, Scotland=Edinburgh) to discuss your requirements (additional charges may apply).

Alternatively you can make an appointment to visit the relevant enquiry office and examine the records yourself.

Records for England and Wales are held at Wallingford where the visitor charge is £9.50/hour (+VAT, with a minimum charge of £19 (+VAT).

Records for Scotland are held with the borehole records at our Edinburgh office the above Borehole Record charges cover them and apply.

BGS Memoirs, maps and open file reports – *contact BGS Sales (details below)*

BGS Memoirs, maps and open file reports relevant to your area can be examined in the appropriate BGS Library. Copies can be ordered from our main Sales Desk: Sales Desk, British Geological Survey, Keyworth, Nottingham NG12 5GG Tel: 0115 936 3241, Fax: 0115 936 3488, E-mail: sales@bgs.ac.uk.

Sales Desks are also located in Edinburgh; Tel: 0131 650 0358, Fax: 0131 667 2785, E-mail: scotsales@bgs.ac.uk, and London; Tel: 020 7589 4090, Fax: 020 7584 8270, E-mail: bgslondon@bgs.ac.uk. BGS London also maintains a reference collection of all BGS publications.

Please check price and P&P before ordering.

Waste Sites – *contact BGS Enquiry Service*

Copies of register entries, containing a variety of levels of data recording, can be obtained from the BGS Enquiry Service (price on application). The registers can also be inspected by visit (see above)

Mine Plans – *contact BGS Enquiry Service*

Mine Plans are available for consultation by prior appointment. Copies can also be obtained - price on application.

Commercial User Ticket – *contact BGS Enquiry Service*

A combined day ticket for commercial visitors to the National Geological Data Centre and the Library is £55 (+VAT) and there is a £33 (+VAT) day ticket for visitors who only wish to use the Library. Frequent visitors can purchase an annual subscription at £275 (+VAT) for access to the NGDC and the Library or £155 (+VAT) for use of the Library only. Further details can be provided on request.

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BGS ENQUIRY SERVICE Contact Details:

Keyworth (KW) Office
For Borehole and other records (excluding water well records & hydrogeological data) in England & Wales (excluding Northern England, and Devon & Cornwall):
Records & Data Enquiries
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Tel: 0115 9363143
Fax: 01159 363276

Exeter (EX) Office
For Borehole and other records (excluding water well records & hydrogeological data) in Devon & Cornwall:
Records & Data Enquiries
BGS Exeter Business Centre
Forde House
Park Five Business Centre
Harrier Way
Sowton
Exeter
Devon
EX2 7HU
Tel: 01392 445271
Fax: 01392 445371

Wallingford (WL) Office
For water well records and hydrogeological data (water levels, water chemistry and aquifer properties) in England & Wales:
Records & Data Enquiries
British Geological Survey,
Maclean Building,
Wallingford,
Oxford
OX10 8BB.
United Kingdom
Tel: 01491 838800
Fax: 01491 692345
Email: hydroenq@bgs.ac.uk

Murchison House (MH or MW) Office:
For water well records and hydrogeological data for Scotland, and all other records in Scotland & Northern England:
Records & Data Enquiries
Murchison House
West Mains Road
Edinburgh
EH9 3LA
Tel: 0131 650 0282
Fax: 0131 650 0252
Email: boreholesnorth@bgs.ac.uk

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Section 8: More detailed geological reports available from BGS

This report forms part of the GeoReports range offered by the BGS Enquiry Service, including reports describing site geology, hydrogeology and geological hazards. For details on these please contact:

BGS Central Enquiries Desk
British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Tel: 0115 936 3143
Fax: 0115 936 3276
Email: enquiries@bgs.ac.uk

Or visit the GeoReports online shop at www.bgs.ac.uk/georeports

Section 9: Supporting Information

- The geological map extracts in Section 5 of this report are extracted from the BGS 1:50,000 scale Digital Geological Map of Great Britain (DiGMapGB-50). More information on DiGMapGB-50 can be found on the BGS website at http://www.bgs.ac.uk/products/digitalmaps/digmapgb_50.html
- Further descriptions of the rocks listed in the map keys in Section 4 can be obtained by searching against the Computer Code (in the map Key) on the *BGS Lexicon of named Rock Units*, which can be found on the BGS Website at www.bgs.ac.uk by following the 'GeoData' link
- Descriptions of how the various rock layers identified on the maps are classified can be found in the BGS Rock Classification Scheme.

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Section 10: Terms and Conditions

General Terms & Conditions

This report is supplied in accordance with the GeoReports Terms & Conditions available on the BGS website at www.bgs.ac.uk/georeports and also available from the BGS Central Enquiries Desk at the above address.

Important notes about this report

- The data, information and related records supplied in this report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps may be lost when small-scale maps are derived from them.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
- Data may be compiled from the disparate sources of information at BGS's disposal, including material donated to BGS by third parties, and may not originally have been subject to any verification or other quality control process.
- Data, information and related records, which have been donated to BGS, have been produced for a specific purpose, and that may affect the type and completeness of the data recorded and any interpretation. The nature and purpose of data collection, and the age of the resultant material may render it unsuitable for certain applications/uses. You must verify the suitability of the material for your intended usage.
- If a report or other output is produced for you on the basis of data you have provided to BGS, or your own data input into a BGS system, please do not rely on it as a source of information about other areas or geological features, as the report may omit important details.
- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.

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