STIRLING BEFORE PYLONS

acting with

FRIENDS OF THE OCHILS

as a Relevant Person Group

for the purposes of the

STIRLING SESSION

of the Public Inquiry into
Scottish & Southern Energy's proposals for the
Beauly to Denny 400 KV Steel Tower Double Circuit
Overhead Electricity Transmission Line

PRECOGNITION

Prof. Michael F Thomas

Stirling's Landscape and Geomorphology

1. My name is Michael F Thomas, FGS, FRSE

2. Qualifications and experience

I am Professor Emeritus in the University of Stirling, and come to this inquiry as a former Professor of Environmental Science at the University, a post that I held from 1980 until retirement in 2001. I hold the degree of PhD in Geography from the University of London (1967), and the degrees of MA and BA (Hons) from the University of Reading. I also studied geology at university and have been a Fellow of the Geological Society of London since 1982, and I was elected Fellow of the Royal Society of Edinburgh in 1988. My research field is *geomorphology*, which is the study of landforms and land-forming processes (such as slope failure, river activity and glacial erosion). My interests include the sensitivity of landscapes to change and instability, either due to climate change or to human impact and I have had field experience in both overseas and Scottish environments. I acted as a consultant on a natural terrain landslide survey for the government of Hong Kong SAR (1998/99), and I have supervised postgraduate research on the history of slope instability in the Scottish Highlands (2003).

I was Joint Editor for 10 years (1995-2005) of the international journal, *Catena* (Elsevier, Holland), which is concerned with 'geoecology and landscape evolution', and have organised several conferences and symposia concerned with land evaluation and landscape sensitivity (for the Royal Society of Edinburgh, The Royal Scottish Geographical Society and the local Forth Naturalist and Historian Board, of which I am currently Chairman). Many of these meetings have led to scientific publications, and I have recently written on "landscape sensitivity and timescales of landscape change" for a volume on *Issues and Perspectives in Landscape Ecology* (Edited by Wiens and Moss, for Cambridge U.P., 2005).

3. Scope of evidence

My evidence concerns the geographic setting and location, geologic setting and landscape sensitivity, potential instability of the terrain to extreme rainfall events and physical disturbance, and a comment on the potential impact of global and regional climate change.

4. Evidence

Geographic setting and location

The city of Stirling stands in a singular position in regard to the physical and historical development of Scotland. Its location appears central and it once housed the administration for the Central Region (1975-1995). But Stirling has most often acted as a gateway to the North, on the margins of the settled lowlands of central Scotland (see satellite image- Document StBP / 4 / 40). The city is located at the constriction of the Forth Valley that provided the historic bridging point for the movement of people, and control of the lands to the North, at least from Roman times. The strategic and political importance of Stirling in the context of the emergence of the Scottish nation is well documented and will be addressed by others. But it is clear that the city has always been at the junction of different regions, its development being both promoted and limited by this location. Stirlingshire belonged to the central lowlands for many centuries as shown by the early maps of John Speed, the Bleau Atlas (1635), Moll (1732) and Groome (1885) (Document StBP / 4 / 41, A,B,C,D) and this administrative arrangement persisted until local government re-organisation in 1975, when creation of the Central Region replaced Stirlingshire and control north to Killin and Tyndrum (Documents StBP / 4 / 42, A). The abolition of the two-tier system in 1995, further confined the Stirling Council to the area north of the industrialised lowlands (Document StBP / 4 / 42, B). Stirling, therefore, lies at the junction between the central lowlands, the western highlands and the distinctive plateaus and plains of northeastern Scotland (see map from Allardyce and Woolnough, 1992 – Document StBP / 4 / 42, C).

Geological setting and landscape

In geology, climate and economy Stirling is also transitional, with coalfields, industry and arable crops to the East; resistant highland rocks and pastures to the North and West (see Browne et al., 1993, Document StBP / 4 / 43. The geological setting is the key to the site of Stirling (see map from SNH, BGS, 1995 – Document StBP / 4 / 44). The ancient (Devonian) volcanic rocks, which form the Ochil Hills are abruptly faulted on their southern margin, forming the dramatic escarpment which dominates the northerly view from Stirling Castle esplanade, and dipping northwest (at 20^{o}-28^{o}) below the softer sandstones that underlie Sheriffmuir and Strathallan. To the South all the land is underlain by later (Carboniferous) rocks, which contain the extensive basaltic lavas that cap the bold escarpments of the Campsie Fells and Gargunnock Hills, and also the younger Coal Measures towards Alloa and Airth. These plateaus of volcanic rock constrict the Forth Valley in the vicinity of Stirling, where they are brought into juxtaposition by strong faulting.

Also critical to the location and story of Stirling are the prominent quartz-dolerite sills (sheets of crystalline igneous rock), injected into the sediments (at the end of the Carboniferous or in the early Permean). These sheets of resistant rock are faulted into a series of tilted blocks on which Stirling Castle and the Wallace Monument at Abbey Craig now stand, continuing southward to form the distinctive escarpment running from Cambusbarron towards Sauchie Craig (Lewis Hill), which overlooks the North Third Reservoir. Thus, from the escarpment of the Ochil Hills to the back slopes of the Gargunnock Hills a series of faults defines a unique combination of bold relief features (SNH, BGS, 1995 – Document StBP / 4 / 44).

When the ice sheets, which once covered the entire landscape, and the glacier that filled the Forth Valley during the later Ice Age, finally retreated (15,000-11,000 years ago), they left deposits of rock debris (known as ‘till’) on less steep slopes and in valleys. Sea level rose and flooded the Forth Valley above Stirling twice in the intervening period, leaving behind clays and silts on which thick peat later accumulated to form the carselands. The upper Forth Valley beyond Stirling became series almost impassable wetlands mostly left as mosses for wildfowl and hunting until the eighteenth century. Historically, Stirling’s access to the North was always through Dunblane or across Sheriffmuir. Today, the abrupt juxtaposition of the low-lying carseland and the enclosing hills is an essential component of the dramatic landscape setting of the castle and the city. From the slopes of Dumyat, on the southern margin of the historic Sheriffmuir the panorama emphasises the mountain-girt, crag-defined site of the city. The most striking views of Stirling are obtained from mid slopes of Dumyat (e.g. along the footpath above Yellowcraig Wood), or from the carseland of the Forth Valley.

The proposed line

The proposed high-tension line must cross the open country from Sheriffmuir, rising across the shoulder of Dumyat and slice through the picturesque woodlands of the escarpment towards Logie (OS, 2001 – Document StBP / 4 / 45). The existing line was constructed shortly after the Second World War, when priorities were different from today and concerns for the environment low amongst national priorities. Today we should have a very different view of such proposals, and take adequate measures to protect and enhance the natural beauty of this key area. There are few, if any, other towns or cities in Britain sited where the junction of mountain and plain is so sharply differentiated, visible and accessible. The proposed development will add to previous intrusions into a scenic area of major importance to the heritage of Scotland. By imposing large new structures on a visually sensitive area damage will be done to one of the most imposing settings of any town in Britain. Indeed, the opportunity should be taken to remove entirely the existing structures and to avoid major visual intrusion into such a nationally important landscape.

Landscape sensitivity and potential instability

The argument goes beyond the preservation of landscape, because construction necessary for new pylons is likely to cause irreparable damage to the sensitive environment of the area, which alternates between bare rock, and pockets of glacial till deposits with a cover of peat or peaty soil. On steeper slopes there are rock outcrops that shed weathered fragments to form small screes, which have sometimes become covered by soil. Such materials are very sensitive to destabilisation. Even if it can be argued that the pylon foundations will be secure and of very limited extent, the access required and machinery used on site could cause irreparable damage and induce localised movement of displaced peat, soil and glacial debris.

Evidence of landsliding and slope failure

Many steep slopes in Scotland's hilly terrain became unstable and were subject to widespread landsliding after the last ice age. The escarpment of the Campsie Fells and Gargunnock Hills, for example, experienced major ground movement, and numerous rockfalls are found within the mountains. This activity has weakened with time, but significant, shallow slope failures and the occurrence of destructive debris flows have continued, and it can be shown that such events have affected the environs of Stirling.

In 1984, an extreme rainfall event led to several slope failures along the Ochil Hills scarp above Menstrie as a result of a November storm which had an estimated 50yr recurrence interval (Jenkins et al, 1988, Document StBP / 4 / 46). The shallow failures in till and peat led to debris flows, one of which engulfed a house with mud. In August 2004, a series of catastrophic debris flows occurred in Glen Ogle and surrounding areas, as a result of a summer convectional storm. This event led to the publication in 2005 of the Scottish Road Network Landslide Study (Scottish Government 2005, web only publication - Summary and recommendations, Document StBP / 4 / 47) recommending detailed surveys of high risk areas to mitigate future risks to the road network. Parallel concerns regarding the stability of blanket-bog peat during energy-related construction projects have also arisen, following catastrophic peat slides in western Ireland in 2003 (at Derrybrien and Pollatomish, County Mayo), and this led The Peat Hazard and Risk Assessment Guide to best practice in peatslide mitigation and management (Scottish Government publication, 2007 section 1 is provided – Document StBP / 4 / 48).

Slope instability was also a major factor leading to the closure by Stirling District Council in 1987 of the Glen Road between Bridge of Allan and Dunblane. Road maintenance ceased and the decade of the 1990s proved to be above average in rainfall. In February 1999 the road pavement in Kippenrait Glen, south of Wharry Bridge (Document StBP / 4 / 45 – see GR799996) was eroded in three places by landslides, and in the intervening years further small slips have occurred. Some of these have been minor adjustments to the residual slopes of the larger slides, but others have taken place *above* the roadway and are therefore unrelated. The entire glen can in fact be shown to comprise a series of repeatedly active landslips, which have occurred in glacial till.

The proposed pylon route from Sheriffmuir to Logie traverses typical combinations of outcropping rock, pockets of glacial till and a cover of peat or peaty soil. From Black Hill to Logie the line crosses a steep tributary of the Logie Burn. While this route avoids some of the highest terrain, parts are very steep and it is elsewhere underlain by till or peat. Any disturbance to drainage by construction or access tracks could, if coinciding with or followed by an extreme rainfall event, trigger debris-flows or other slope failures. Weakened slopes may also fail at a future date.

Possible impacts of climate change

It is necessary now to envisage the possible effects of global climate change on these factors. In 2004, the Natural Environment Research Council established a programme on 'Landslides, flooding and climate change in the UK' in which recent landslide events in Scotland are a subject of concern (Document StBP / 4 / 49). Within the NERC, the British Geological Survey has also launched a service called 'Geosure'. This calls for environmental sensitivity mapping and ground stability surveys and locates areas of 'significant' landslide potential in Great Britain, which includes the Ochil Hills (BGS 2007, Landslide Potential Map – Document StBP / 4 / 50). These programmes anticipate the findings of the Intergovernmental Panel report 'Climate Change 2007', which will be published in full in November 2007. Since the present level of risk from landslides in this area is regarded as 'significant' (Document StBP / 4 / 50), an increase in frequency of flooding and landslides as natural hazards in the future, implies increased exposure to risk during and following any construction on the sensitive slopes of the Ochil Hills and that such construction should be avoided.

Summary

1. The location of Stirling and its geologic and topographic setting are unique in Scotland and have largely determined the historical significance of the city.
2. Stirling is neither a lowland nor a highland city, but lies at a critical junction of rocks, structures, relief, climate and economy. Its historical command of the routes from the East and South towards the North gave Stirling national significance and strategic importance.
3. Details of the site are scenically striking, due to the juxtaposition of crag and carse, and the constriction of the Forth Valley by faulting of the volcanic rocks and tilted sheets of dolerite.
4. Both the carseland west of Stirling and the escarpment of the Ochil Hills below the summit of Dumyat are key elements in the landscape and particularly sensitive to intrusion by construction.
5. Stony soils, glacial till and potentially unstable peat combined with locally steep slopes contribute to physical sensitivity and potential instability during

and after construction, and may become increasingly liable to erosion or failure due to global and regional climate change.

Documents

StBP / 4 / 40 Scotland from Space (satellite image of Scotland published 21/10/2006 by The Scotsman / Planet Observer, 2006.

StBP / 4 / 41 A, B, C, D. Historic maps of Stirlingshire: A. John Speed (after Pont) c 1600, B. Bleau Atlas, 1635; C. H. Moll, 1732 (source National Library of Scotland); D. Groome 1885 from Ordnance Gazeteer of Scotland, Thomas C. Jack, Edinburgh.

StBP / 4 / 42 A, B, C. Recent maps of Stirling: A. Central Region, 1975-1995; B. Stirling Council 1995-2007; C. Allardyce K., and Woolnough, K., 1992. *Scotland in Focus*. Harper Collins, Glasgow (ISBN 0-00-4356519), Fontispiece.

StBP / 4 / 43 Browne, M.A.E., Mendrum, J.R. and Monro, S.K., 1993. Geology. In Corbett, L. and Dix, N.J. (Editors), 1993. *Central Scotland: Land – Wildlife – People*. Forth Naturalist and Historian/ Stirling University, pp 1-17.

StBP / 4 / 44 Scottish Natural Heritage / British Geological Survey ,1995. *Loch Lomond to Stirling – A Landscape Fashioned by Geology* (ISBN 1-85397-119-7). Map of the bedrock geology.

StBP / 4 / 45 Ordnance Survey 2001. Stirling and Ochil Hills West, OS Explorer Map, 1:25,000, Sheet 366, 2001 (Extract).

StBP / 4 / 46 Jenkins, A., Ashworth, R., Ferguson, R.I., Grieve, I.C., Rowling, P, and Stott, T.A.,1988. Slope failures in the Ochil Hills, Scotland November 1984. Earth Surface Processes and Landforms 13, 69-76.

StBP / 4 / 47 The Scottish Government publications: Scottish Road Network Landslides Study, 2005. Section 9 Summary (web only publication – http://www.scotland.gov.uk/Publications/2005/07/08131738/17559)

StBP / 4 / 48 The Scottish Government publications: Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments Section 1 Introduction (web only publication - http://www.scotland.gov.uk/Publications/2006/12/21162303/0)

StBP / 4 / 49 Natural Environment Research Council (NERC), 2004. Landslides, flooding and climate change in the UK. Research programme (web only publication - http://www.nerc.ac.uk/press/releases/2004/25-landslides.asp

StBP / 4 / 50 British Geological Survey (BGS) / NERC 'Geosure' project: Map of Landslide Potential for Great Britain. http://www.bgs.ac.uk/products/geosure/