APPENDIX 4.1 TRACK LAYOUT DESIGN STRATEGY

INTRODUCTION

The design team recognised at the start of the design process that addressing peat constraints was a crucial aspect of the design process for the network of construction, operational and borrow pit tracks. A strategy was therefore developed to inform the initial track layout design, the suggested routes subsequently being subjected to ground truthing at later stages of the design iteration process. The table below summarises the initial strategy.

Inevitably the final layout of tracks has involved compromise between engineering, peat management and other environmental interests. The strategy laid out here describes the first stage of the design process which provided a foundation for subsequent iterations. It is important to remember that this document describes the strategy that was adopted as a first attempt to design the track layout with regard to the peatland conditions on the site.

Ground conditions are ranked in order of preference for track construction, with Types 1 and 2 being strongly preferred and Types 7 to 10 ideally not featuring at all in the track network. The two right-hand columns explain the underlying thinking, which is based on the likelihood of achieving hydrological invisibility to the peatland system for each type of track and the potential for the track to contribute positively to peatland restoration.

Preference level	Type	Ground Conditions	Track design strategy	Restoration strategy
STRONGLY PREFERRED	1	Watershed without peat ('mineral'); may have patchy re-vegetation but not complete or almost-complete cover (at which stage it becomes Type 10).	Minimal imported materials, low sediment generation, appropriate mineral/nutrient level, allow free water movement. Route ideally follows watershed, but deviation from this line (bends, junctions etc. to suit operational requirements) permissible. Removal of any vegetation that would otherwise be buried for re-use in restoration elsewhere.	Re-vegetation encouraged around track, aiming to leave as recovering mesotope centre on decommissioning; immediate focus on stabilising/restoring more peripheral parts of mesotope (edge-to-centre recovery)

Preference level	Type	Ground Conditions	Track design strategy	Restoration strategy
STRONGLY PREFERRED	2	Watershed with eroded peat, selecting bare peat, bare peat with fragmented haggs, heavy anastomising erosion, heavy dendritic erosion etc. in that order; in general, the more bare peat and the shallower it is, the better.	As for 1, although deviation from line of watershed, bends, junctions etc. becomes less acceptable as peat becomes thicker. In thicker peat, becomes cut track; strip off peat and hagg tops for use in restoration.	Stabilise/re-vegetate bare peat up to edge of track by encouraging appropriate vascular plants ('dry restoration') – look for *Sphagnum* to follow; similar to Type 1.
PREFERRED	3	Follow existing drainage line (e.g. linear erosion gully perpendicular to contours) on sloping ground.	Track will remain a drainage line. Will probably require low-permeability batters and trackside ditches, plus a means of dispersing water appropriately at downslope end of section. Water management required at junctions with watershed (Type 1 and 2) and contour (Type 4) routes.	Gully remains a drainage line for life of windfarm. Requires further attention (reinstatement) at windfarm decommissioning.
PREFERRED	4	Follow contour perpendicular to linear erosion gullies, choosing thinnest (hagg) peat available.	Hybrid 'floating'/'peat replacement' design with appropriate arrangements for retaining/transmitting water; different hydrological considerations for near-summit and slope-foot locations.	Aim for 'hydrological invisibility'; track becomes permanent part of mineral template, assists in stabilising peat/mesotope structure, imposing acrotelm/catotelm flow pattern in haggs and slowing water movement in gullies in a way that is consistent with recovery of vegetation on haggs and revegetation of gullies.

Preference level	Type	Ground Conditions	Track design strategy	Restoration strategy
AVOID IF POSSIBLE	5	Thick peat edges alongside burns/soakways.	Peat here appears to be up to 4m thick, but can often be avoided by moving slightly upslope. Track construction as for 4 but may present additional technical challenges.	Unwise to disturb peat edge as this 'seals' the edge of the mesotope. Encourage appropriate re-vegetation of penetrating gullies to reduce sediment yield and start 'edge-to-centre'- mesotope recovery (especially beneficial in reducing sediment/ POC input to watercourses). Contour track placed in thinner peat upslope should help by retarding flow in gullies (but must allow discharge of stormflow).
AVOID WHEREVER POSSIBLE	6	Routes that run at an angle to both flow lines and contours. Acceptable where essential on steep access routes with thin peat.	Design to ensure that track does not become additional drainage pathway. Cable trenching to incorporate barriers to preferential drainage through cabling sand.	Unlikely to be helpful for peatland restoration objectives.
AVOID	7	Re-vegetated mineral watersheds with no sphagnum or peat formation yet.	It should not be necessary to put tracks here. If essential, procedure would be as for 1 and 2; strip vegetation and use for restoration elsewhere.	These are spontaneously recovering mesotope centres; expedient to take precautionary approach and avoid unless track cannot be routed elsewhere.
STRONGLY AVOID	8	Watersheds with recovered *Sphagnu*m carpets; very wet, often with small pools, and usually with one or more decimetres of acrotelm/peat.	It should not be necessary to put tracks here. If essential, procedure would be more or less as for 1 and 2; strip vegetation and use for restoration elsewhere.	These are spontaneously recovering mesotope centres; expedient to take precautionary approach and avoid unless track cannot be routed elsewhere.
STRONGLY AVOID	9	Watersheds that retain intact mesotope centres, even if erosion gullies have reached them.	It should not be necessary to put tracks here; use Type 4 tracks to skirt intact peat.	Encourage re-vegetation of erosion gullies progressively downslope from 'core remnant' (centre-to-edge recovery of mesotope).
	10	Watersheds with red throated diver lochans		

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NOTES

The term 'watershed' is used here to denote all convex (e.g. summits, ridges, spurs) and half-convex (e.g. saddles) landform elements. These will be mesotope centres (i.e. centres of the fundamental landscape units of the peatland) in the target healthy/active blanket mire system.

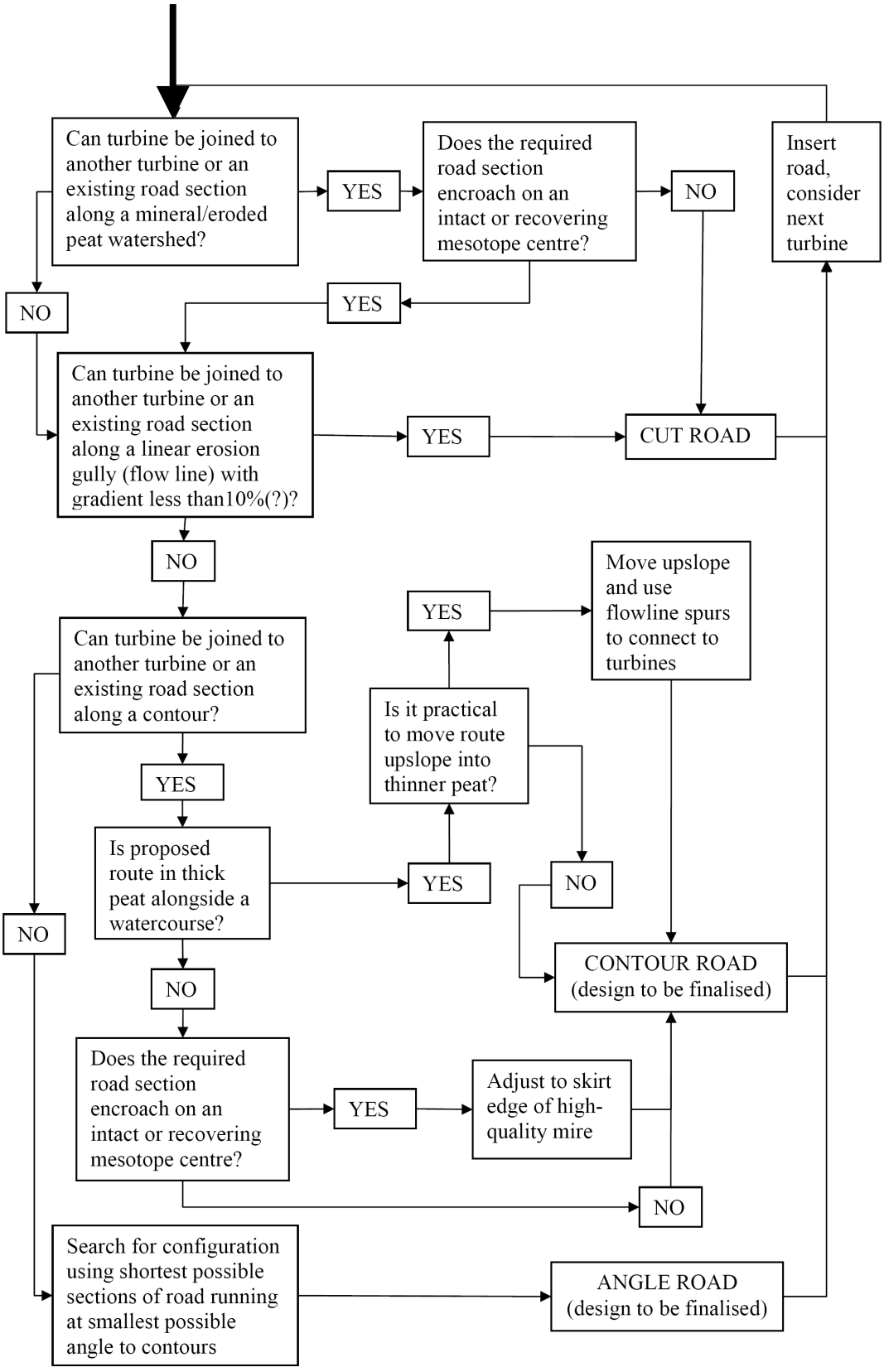
The above scheme was developed by examining 1999 black-and-white air photographs in a GIS environment, in conjunction with OS maps, the turbine layout, peat probing data and surface contours in vector format; air-photo interpretation to delineate areas that would be more and less suitable for tracks focusing on peatland requirements; and modelling potential track routes.

Examination of air photos in conjunction with Ordnance Survey (OS) maps underlines the fact that OS mapping of watercourses in such terrain is unreliable in places. Therefore some of the mapped upper reaches of streams are actually erosion gullies; the 'natural' state would be a peatland soakway rather than a discrete stream. The appropriate treatment for healthy peatland is to dam or slow down water movement in erosion gullies. Therefore insertion of standard 'stream crossings' at all points where the windfarm track network intersects with OS mapped watercourses may well be antagonistic to this objective (i.e. damaging to peatland interests). Proposed "stream" crossings should therefore be considered on a case-by-case basis on site during construction.

It is not always easy to distinguish between re-vegetated mineral (Types 10/11) and remnant intact (Types 13/14) summits from the air photos without ground truthing. However, as it would be preferable to avoid placing tracks on either type of surface, the distinction is not of primary importance for track routing. The difference between mineral/bare peat and vegetated/intact watersheds is mostly clear even on black and white air photos.

The above scheme focuses largely on convex (hilltop) landforms. Concave (valley) locations are flagged as likely to have significantly different characteristics (e.g. thicker peat and larger catchments meaning more water to disperse) relevant to track routing and design (see Type 5). Also, it is likely that flat areas between large lochs (e.g. in Kergord quadrant) will be highly unsuitable for tracks as they will be very wet with deep peat.

For a summary of the process please see the following flow diagram.



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