

14.1.PS-DETAILED ASSESSMENT

8 DETAILED ASSESSMENT

Following the ground investigation works a more detailed assessment of the peat landslide hazard has been carried out for each of the locations previously identified.

The following pages contain detailed information on each of the locations, including the collated results of the ground investigation works where applicable, calculated factors of safety based on these results, aerial photography of the location overlaid with pertinent geomorphological information, and a discussion/interpretation of the presented information. An indication of possible peat slide parameters is given for reference. This assumes that the peat will fail for the full length of the slope and is considered to give a worst-case estimate.

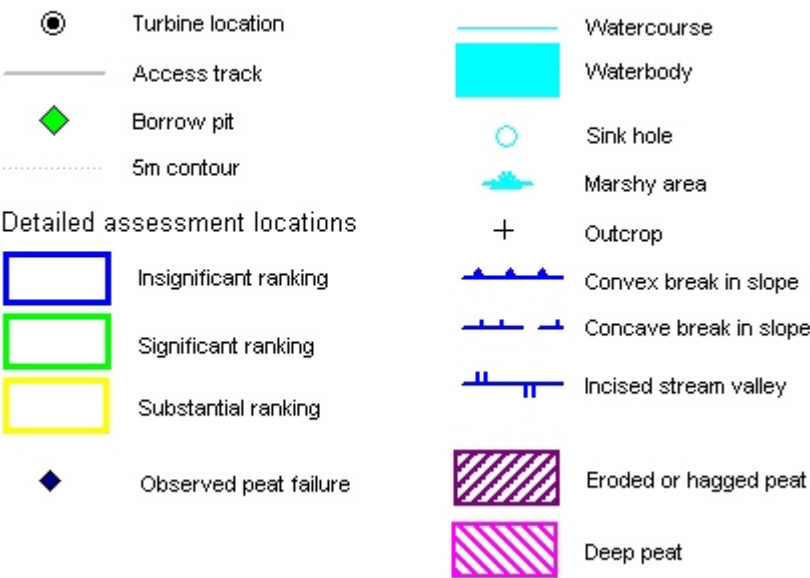
Where relevant, mitigation measures are recommended. Finally, the hazard ranking of each location has been reappraised in the light of the presented information and proposed mitigation.

The factor of safety calculations presented are based on the collated GI data. FoS values have been calculated for each measured shear strength value and using the bulk density value from the relevant peat sample. The minimum calculated FoS value has been taken into account when reappraising the hazard ranking at each location.

In the following pages, the insert maps are a composite of aerial photography and geomorphological information. The wider context may be viewed if required by reference to Figures 14.1.PS04 and 14.1.PS05 in this volume. A legend for the symbols used in the insert maps is given in Figure 39 below. The detailed assessment locations are based on 100m x 100m cells, giving an idea of scale on the associated images.

Figure 39 Legend for the detailed assessment insert maps

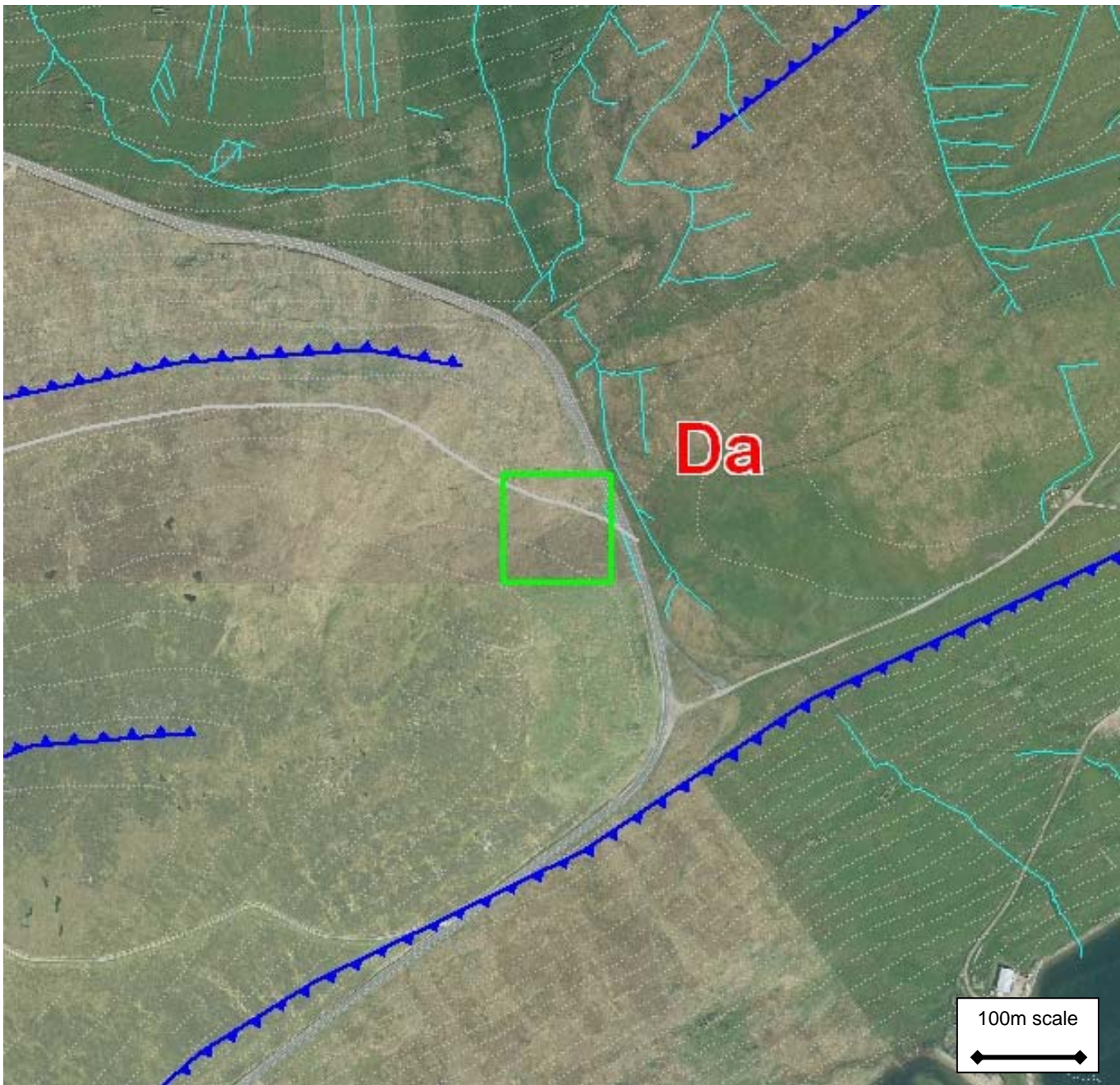
Legend



Mitigation measures have been recommended for a number of the locations assessed in detail. In several cases the primary mitigation recommendation has been micro-siting of the access track away from the area of concern.

LOCATION Da

Grid Reference	HU 4455 7305	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 9	Depth (m)	-							
Max. Depth (m)	2.1	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.0	Primary receptor (stream order)	A970
Width (m)	110		
Down slide distance (m)	60	Secondary receptor (stream order)	Unnamed tributary to Firths Voe (1)
Up slide distance (m)	150		
Volume (m³)	23,100		

Comment / Description
Location <b>Da</b> is situated on the north side of a wide, fairly flat col which is crossed by the main A970. Peat depths in the surrounding area range between 0.3 and 2.1m, although most depths are <1m. The site is on a moderate slope with the road alignment running parallel to the contours. The nearest watercourse is a drainage channel beside the A970, approximately 60m downhill from the site with an intervening slope of 8°. The watershed is 150m uphill of the site with an intervening slope of 8°. Ground conditions underfoot were dry and well-vegetated including a considerable proportion of heather, indicating dry conditions are common. No signs of instability were observed. Although preliminary assessment highlighted this site as at risk of peat slide, deep peat and steep slopes were found not to be coincident upon closer inspection.

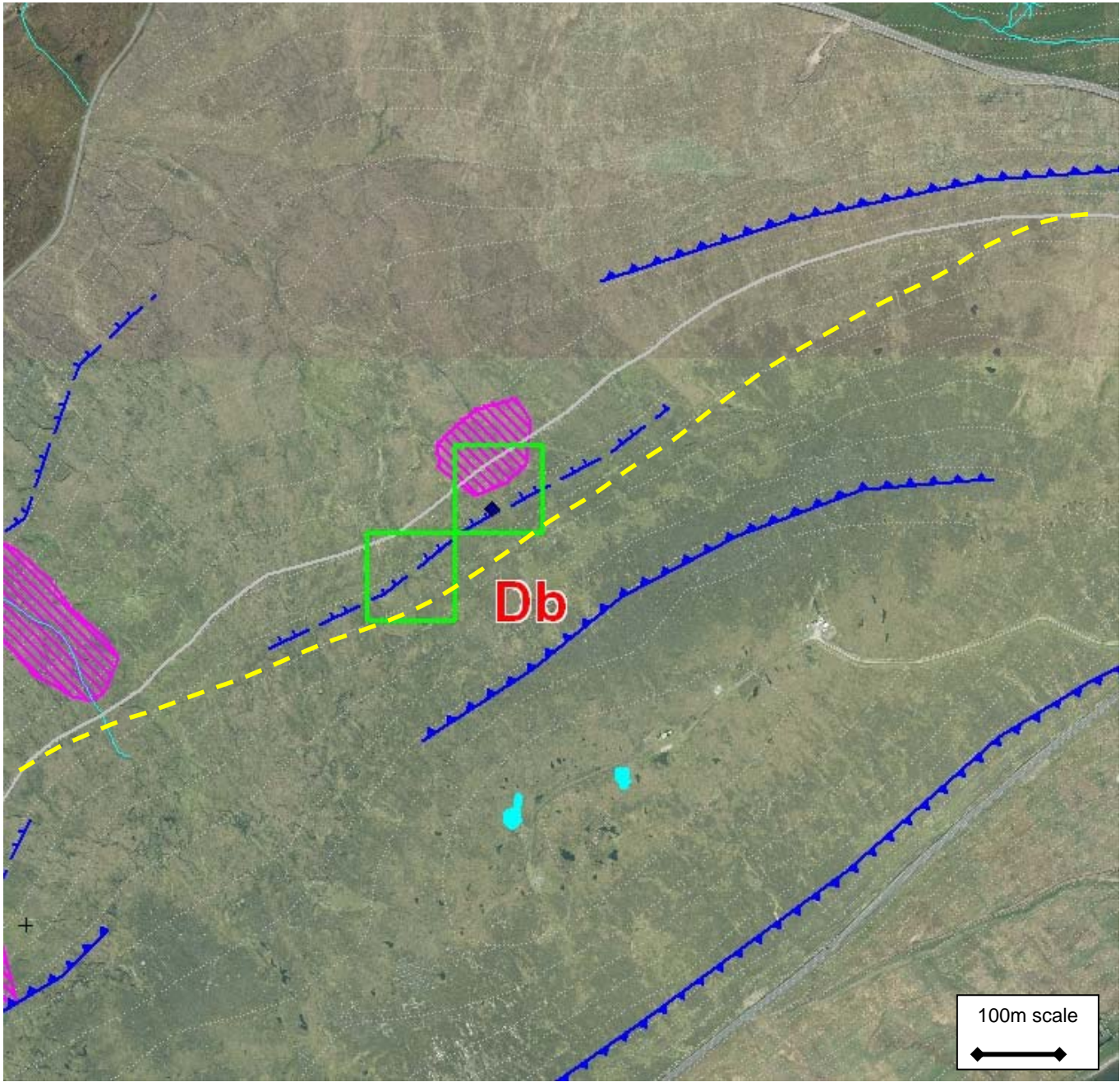
Mitigation
From a peat stability perspective, no mitigation is necessary as the risk of a peat slide is insignificant. However, risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Db

Grid Reference	HU 4360 7280	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	5 – 11	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.8	Primary receptor (stream order)	Minor road
Width (m)	240		
Down slide distance (m)	620	Secondary receptor (stream order)	B9076
Up slide distance (m)	240		
Volume (m³)	577,900		

Comment / Description
Location <b>Db</b> is situated on the side of a hill just below a distinct concave break in slope. Slope angles along the track line are fairly low, around 6°, and measured peat depths range between 2 and 4m. The peat was generally dry with little surface erosion, although some waterlogged drainage channels were present c. 30m downhill. A narrow water-filled crack was present at the break in slope at the northern end of the site but was not present in the southern half. The crack was not a recent feature and ran for approximately 30m along the slope, was 0.8m deep to mineral soil, with 0.3m of water. There are no watercourses within close proximity to the location. Above the break in slope, slope angles steepen to about 11°. Below the track line, slope angles remain at 6° or less.

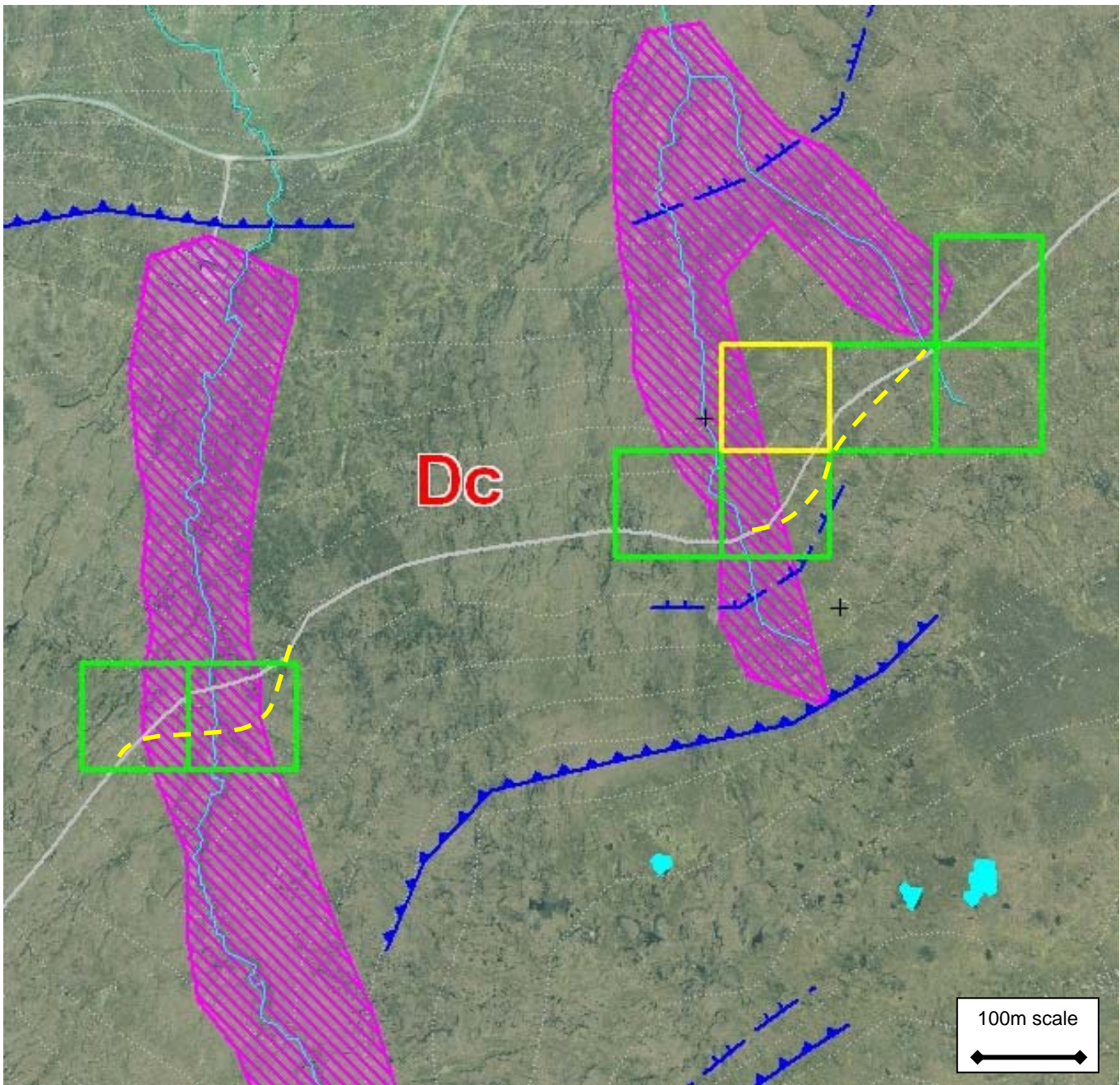
Mitigation
The presence of an observed instability indicates that this area is of concern. Micrositing of the track upslope to the south-east, above the observed crack and onto the steeper and drier ground, is strongly recommended. This may cause problems for heavy construction plant as slope angles along the track will be increased; in this case the track may need to be downgraded to operations-only track. The risks should continue to be appraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Dc

Grid Reference	HU 4293 7242	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	3 – 10	Depth (m)	-							
Max. Depth (m)	3.1	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.9	Primary receptor (stream order)	Unnamed tributary to North Burn (1)
Width (m)	490		
Down slide distance (m)	150	Secondary receptor (stream order)	North Burn (2)
Up slide distance (m)	260		
Volume (m³)	381,700		

Comment / Description
Location <b>Dc</b> lies along the northern slope of a ridge, crossed by a series of small watercourses. Slope angles are fairly low and measured peat depths range from 1.1 to 3.1m. Deep peat tended to be found within the watercourse channels. The preliminary assessment highlighted this area as being at risk of peat slide owing to the occurrence of deep peat and steep slopes within one grid cell. However, closer inspection revealed that they are not coincident, although two areas combine deep peat and moderate slope angles. Ground conditions were generally dry in the area, with good vegetation cover. No signs of instability were observed.

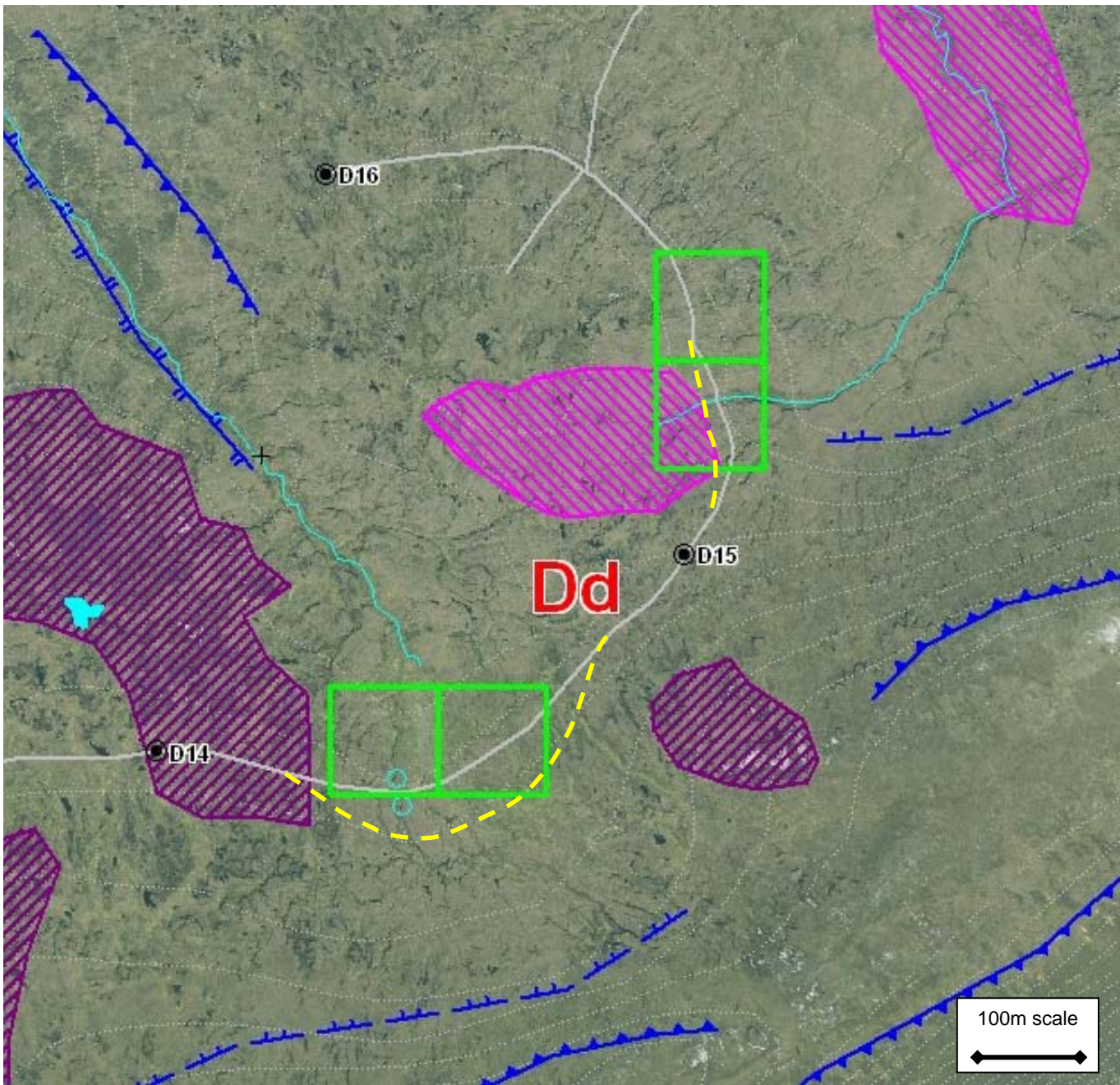
Mitigation
It is recommended that the track line is microsites slightly to the south-east of the current alignment in two areas, both to take advantage of shallower slope angles and to minimise crossing areas of deeper peat. Risks should continue to be appraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	3	High Impact	12	Substantial
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Dd

Grid Reference	HU 4228 7147	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	1 – 11	Depth (m)	-							
Max. Depth (m)	3.6	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.2	Primary receptor (stream order)	Unnamed tributary to Burn of Laxobigging (1)
Width (m)	215		
Down slide distance (m)	120	Secondary receptor (stream order)	Burn of Laxobigging (3)
Up slide distance (m)	290		
Volume (m³)	193,900		

Comment / Description
Location <b>Dd</b> is situated near the headwaters of small watercourses. The northern part is on the side of a wide, flat col with deep peat (1.3-2.5m) and mostly fairly modest slope angles. The southern part is in a wide open valley with low slope angles and moderate to deep peat (1.7-3.6m). This area has a partially collapsed peat pipe and may have more pipes not currently visible. Although the steepest slope angles and deep peat measurements within a single grid cell are not coincident, the presence of a collapsed peat pipe is indicative of minor instability and should be avoided.

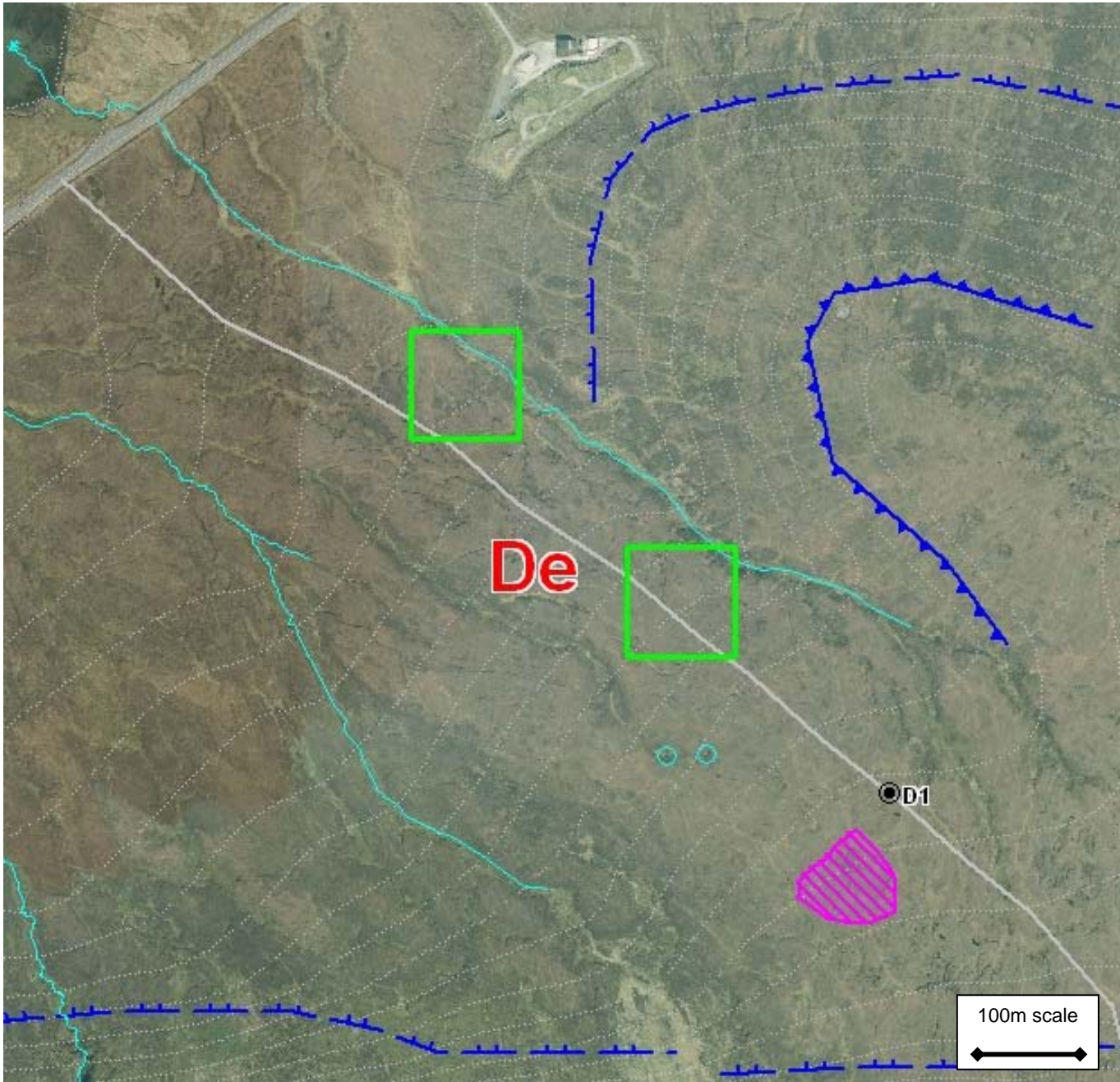
Mitigation
It is recommended that the track alignment is micrositied to areas with lower slope angles and to avoid the known peat pipe. Suggested realignments are, in the southern part, to the south, and in the northern part, to the west, as shown. Care will be required to identify the extent of the peat pipe in the southern area. Floating track construction is recommended for the northern section. Risks should continue to be appraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION De

Grid Reference	HU 4015 7265	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	1 – 15	Depth (m)	-							
Max. Depth (m)	2.9	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.8	Primary receptor (stream order)	Unnamed tributary to Houb of Scatsta (1)
Width (m)	50		
Down slide distance (m)	130	Secondary receptor (stream order)	B9076
Up slide distance (m)	200		
Volume (m³)	29,700		

**Comment / Description**

Location **De** is situated on a long slope running down to the B9076. Slope angles vary between 7° on the upper slopes and 2° near the road. The watercourse located north-east of the track line is incised and has slope angles up to 17° in places. Measured peat depths range from 1 to 2.9m. Preliminary assessment highlighted this area as a potential risk location owing to the steep slopes and deep peat within a single grid cell. Detailed inspection indicated that they are not coincident, with steep slopes in the stream valley and deep peat on the hill slopes. Owing to the slope aspect, any failure that were to occur would slide to the north-west, towards the road, rather than impacting on the watercourse. Two small sink holes were identified south of the location, indicating the presence of a peat pipe. Additional peat pipes may be present in the area.

**Mitigation**

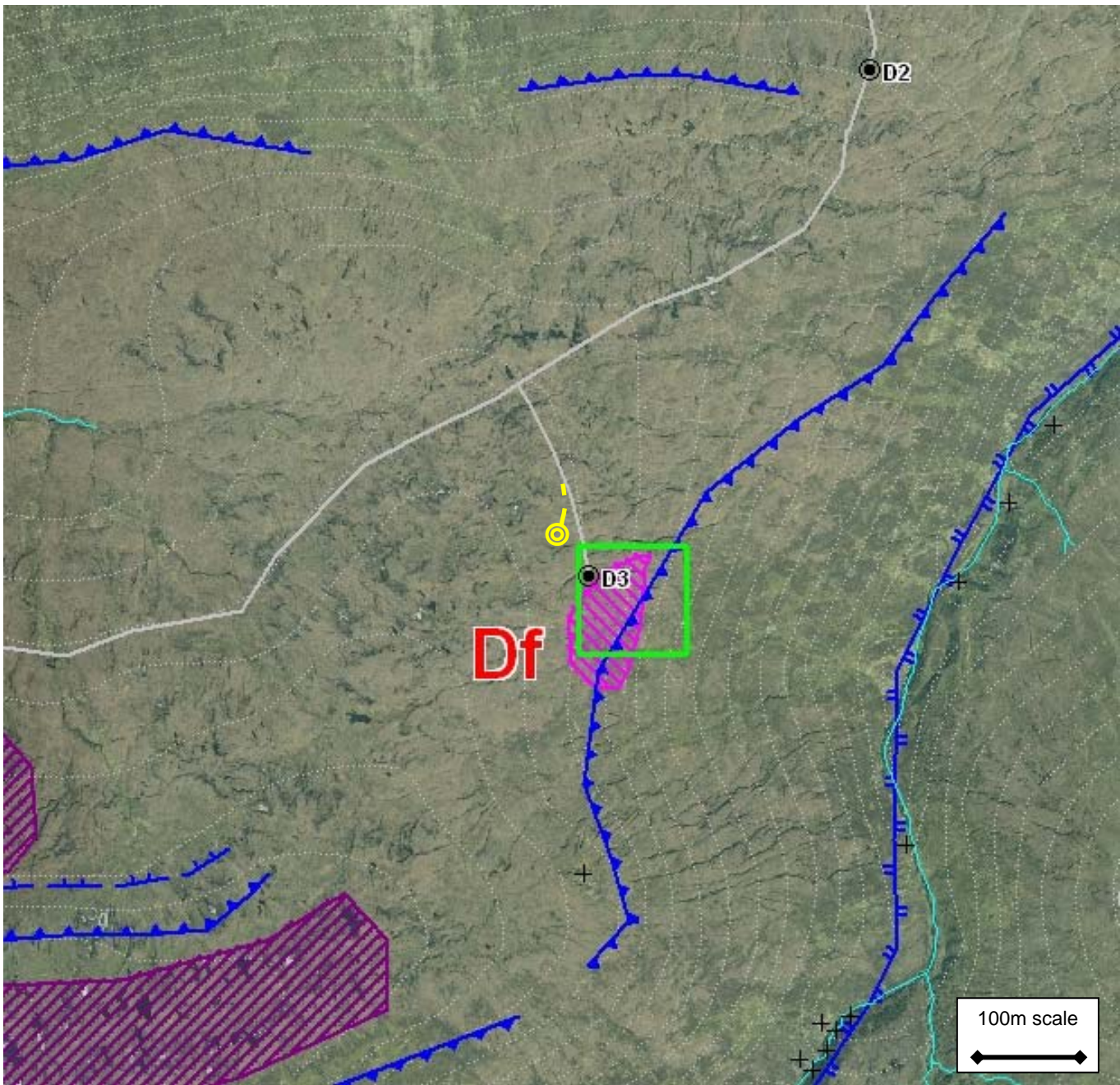
From a stability perspective, no mitigation is necessary. Construction staff should be made aware of the possibility of further peat piping in the area. Risk should continue to be reappraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	2	Low Impact	2	Insignificant



LOCATION Df

Grid Reference	HU 4055 7145	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	5 – 13	Depth (m)	-							
Max. Depth (m)	2.6	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2	Primary receptor (stream order)	Burn of Laxobigging (3)
Width (m)	60		
Down slide distance (m)	330	Secondary receptor (stream order)	Minor road
Up slide distance (m)	130		
Volume (m³)	55,200		

Comment / Description
Location <b>Df</b> coincides with Turbine D3 and is situated on the flank of a broad hill. The location has deep peat, with measured depths ranging from 1.5 to 2.6m. A convex break in slope has been identified crossing the location; slopes above this are up to 9°, and below steepen to 13°. The base of the steep slope is marked by the Burn of Laxobigging, which has a prominent incised channel. The area was flagged by the preliminary assessment as being at risk of peat landslide through the presence of deep peat and steep slopes within the grid cell. Closer inspection revealed that these are not coincident. However, deep peat does lie along the break in slope and the turbine location is immediately adjacent to the area of deep peat.

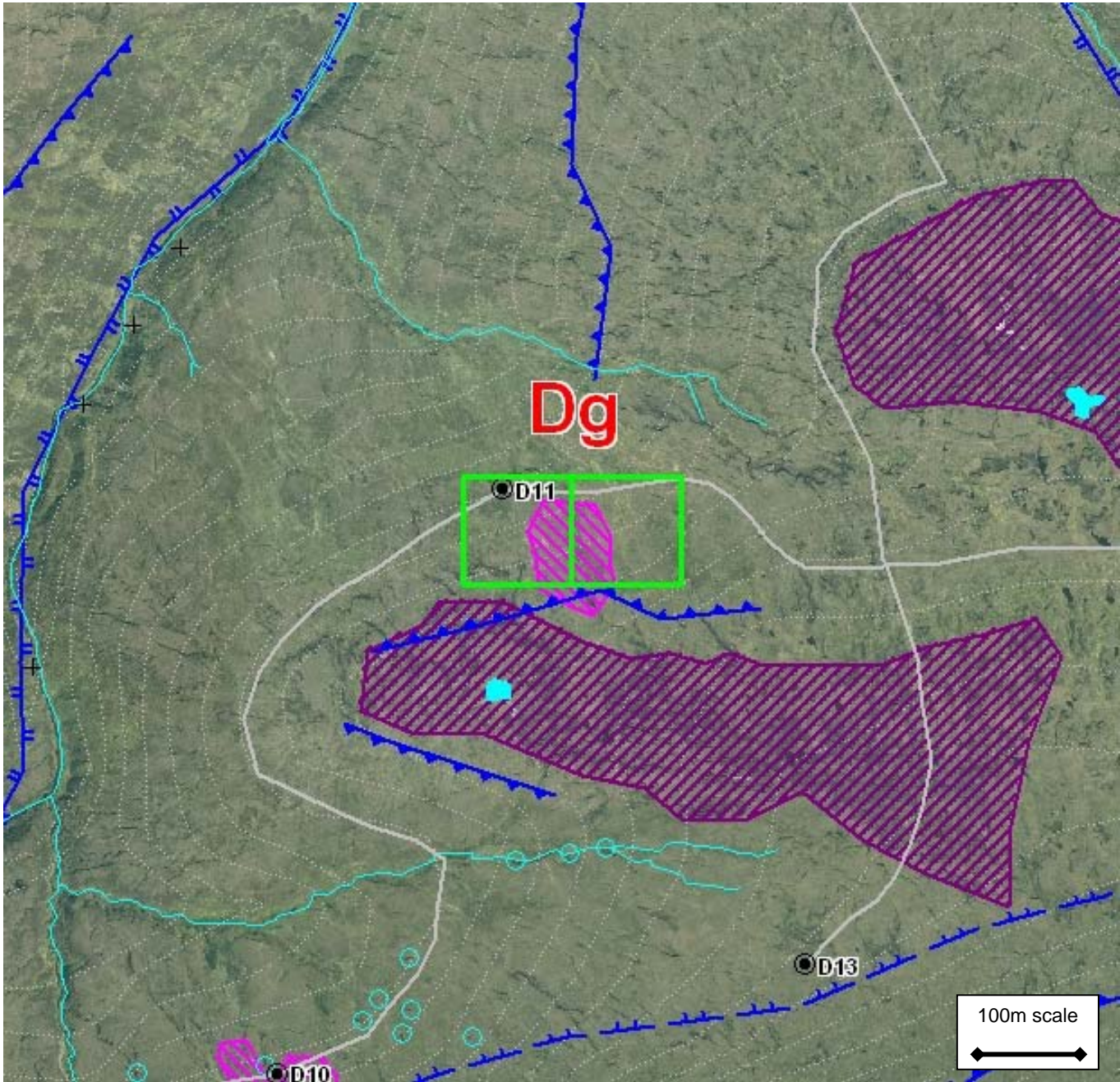
Mitigation
It is recommended that Turbine D3 is microsituated to the north-west, as indicated, to an area with shallower slope and to avoid the deep peat. Distance from the convex break in slope will also be increased by this relocation. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	2	Low Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Dg

Grid Reference	HU 4130 7135	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	4 – 11	Depth (m)	-							
Max. Depth (m)	3.5	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.6	Primary receptor (stream order)	Unnamed tributary to Burn of Laxobigging (1)
Width (m)	200		
Down slide distance (m)	170	Secondary receptor (stream order)	Burn of Laxobigging (3)
Up slide distance (m)	200		
Volume (m³)	192,400		

Comment / Description
Location <b>Dg</b> lies on the flank of a broad ridge and coincides with Turbine D11. Part of the area has deep peat, with measured peat depths ranging between 1.6 and 3.5m. Slope angles are mostly around 7-9°, steepening towards the watercourse to the north and becoming gentler above the break in slope south of the location. Preliminary assessment identified the location as a potential risk area for the occurrence of deep peat and moderately steep slope angles within the same grid cell. Upon closer inspection, it was apparent that these occur in separate parts of the cells. The convex break in slope identified above the location is at least 90m distant from proposed infrastructure and no signs of instability were observed in the area.

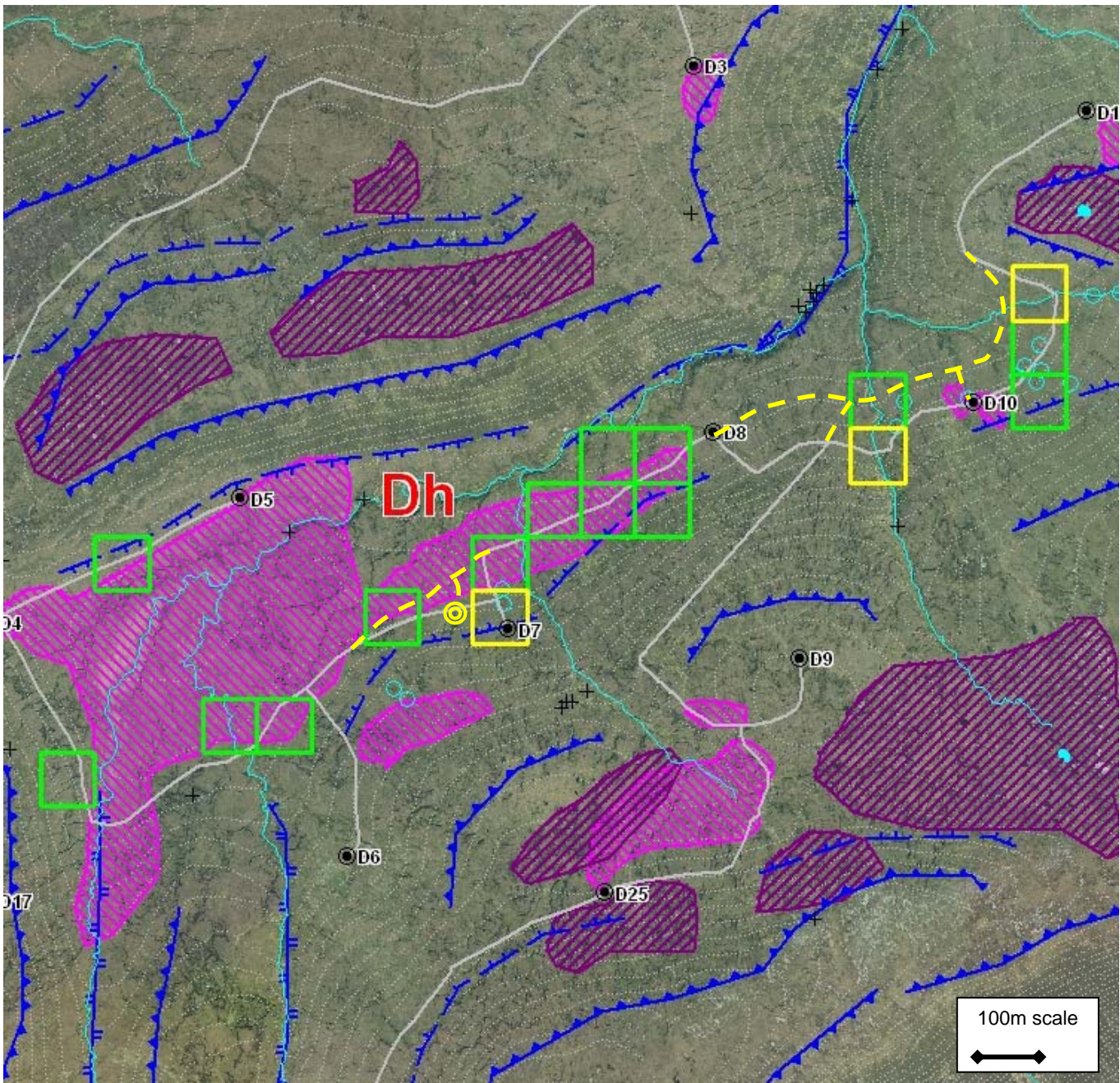
Mitigation
Risk of peat landslide is insignificant, so therefore there is no mitigation necessary. Risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	2	Low Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Dh

Grid Reference	HU 4015 7057	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 23	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.5	Primary receptor (stream order)	Tributaries to Burn of Laxobigging (1,2)
Width (m)	500		
Down slide distance (m)	160	Secondary receptor (stream order)	Burn of Laxobigging (3)
Up slide distance (m)	430		
Volume (m³)	737,500		

Comment / Description
Location <b>Dh</b> covers an area around the upper part of the Burn of Laxobigging and includes Turbine D7. This area was visited as part of the reconnaissance survey and is documented as Area D1 in the Reconnaissance Survey section of this report. Deep peat was found across much of the base of the valley; the valley sides have steep slopes with angles varying between 6 and 23°. The location is crossed by several tributary watercourses which are incised in their upper reaches; this gives rise to the steeper slope angles. These cells were highlighted as at risk of peat landslide in the preliminary assessment through a combination of deep peat and steep slopes within the grid cells. Closer inspection indicates that, in most cases, the deep peat occurs on gentle slopes, with steep slopes occurring in other parts of the cells. Concave breaks in slope are indicated around the valley floor. Collapsed peat pipes were identified particularly at the eastern end of the location.

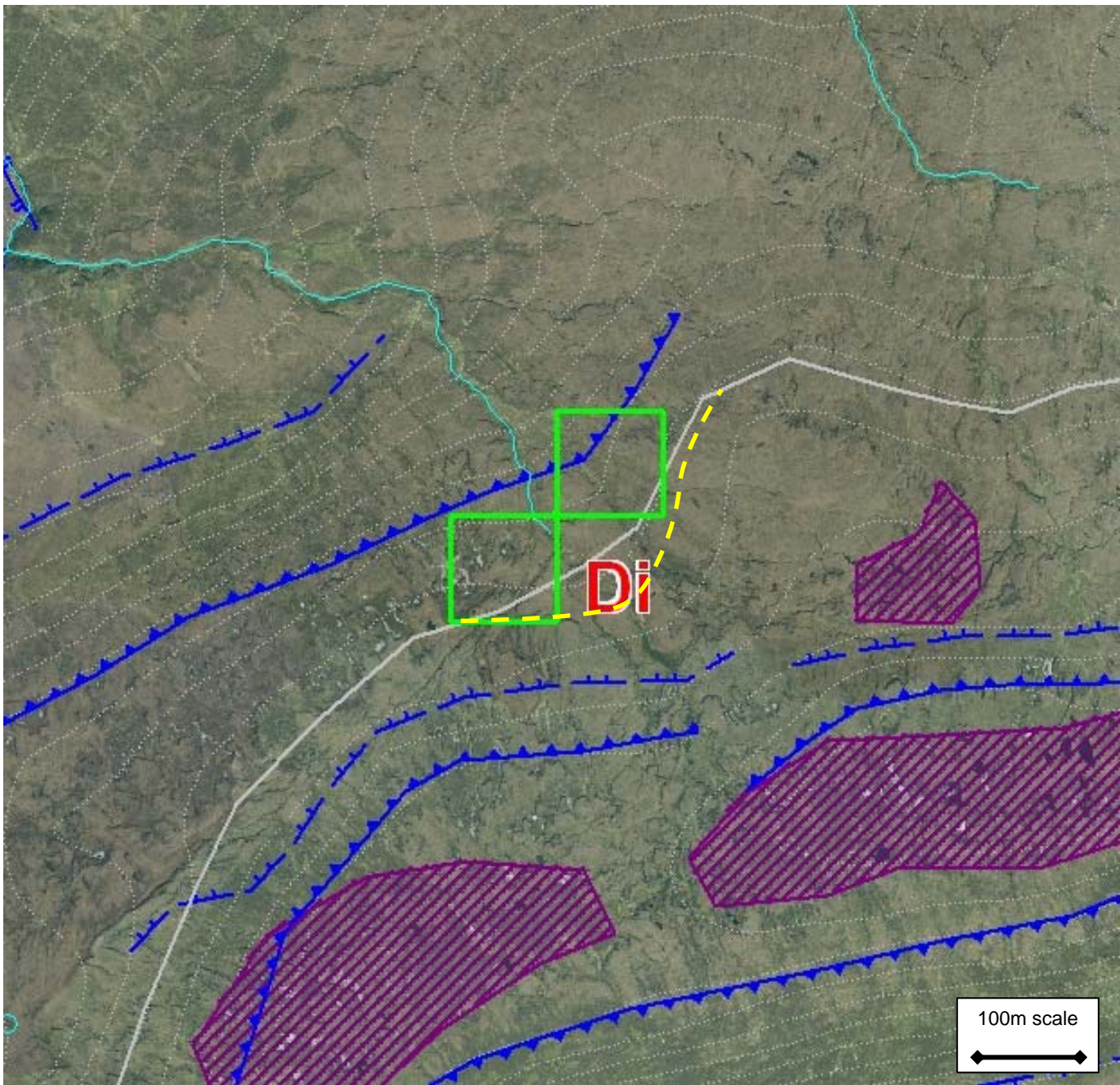
Mitigation
It is recommended that much of the track is micrositied downslope to avoid highlighted risk areas and identified peat pipes. Turbine D7 is also likely to require micrositing downslope out of the risk area. Floating track construction is recommended for track sections in the western part of the location. Attention will be required in the track design to avoid disruption of subsurface flow within the peat. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout construction.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	3	High Impact	12	Substantial
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Di

Grid Reference	HU 3960 7130	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	1 – 9	Depth (m)	-							
Max. Depth (m)	3.2	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.3	Primary receptor (stream order)	Tributary to Burn of Scatsta (1)
Width (m)	250		
Down slide distance (m)	300	Secondary receptor (stream order)	Burn of Scatsta (3)
Up slide distance (m)	290		
Volume (m³)	339,300		

Comment / Description
Location Di is situated on the shoulder of a wide hill, about 80m uphill from a convex break in slope. Slope angles above this are between 2 and 8°, increasing to 12-16° below the break in slope. Recorded peat depths range from 1.7 to 3.2m, but are mostly less than 2.5m. This location has undergone fairly extensive erosion, especially in the southern half, where peat has been eroded to mineral soil in some areas. The peat is mostly quite dissected by drainage channels which provide the headwaters to a small watercourse. Although the location includes both deep peat and steep slopes, closer inspection of the cells indicates that they are not coincident.

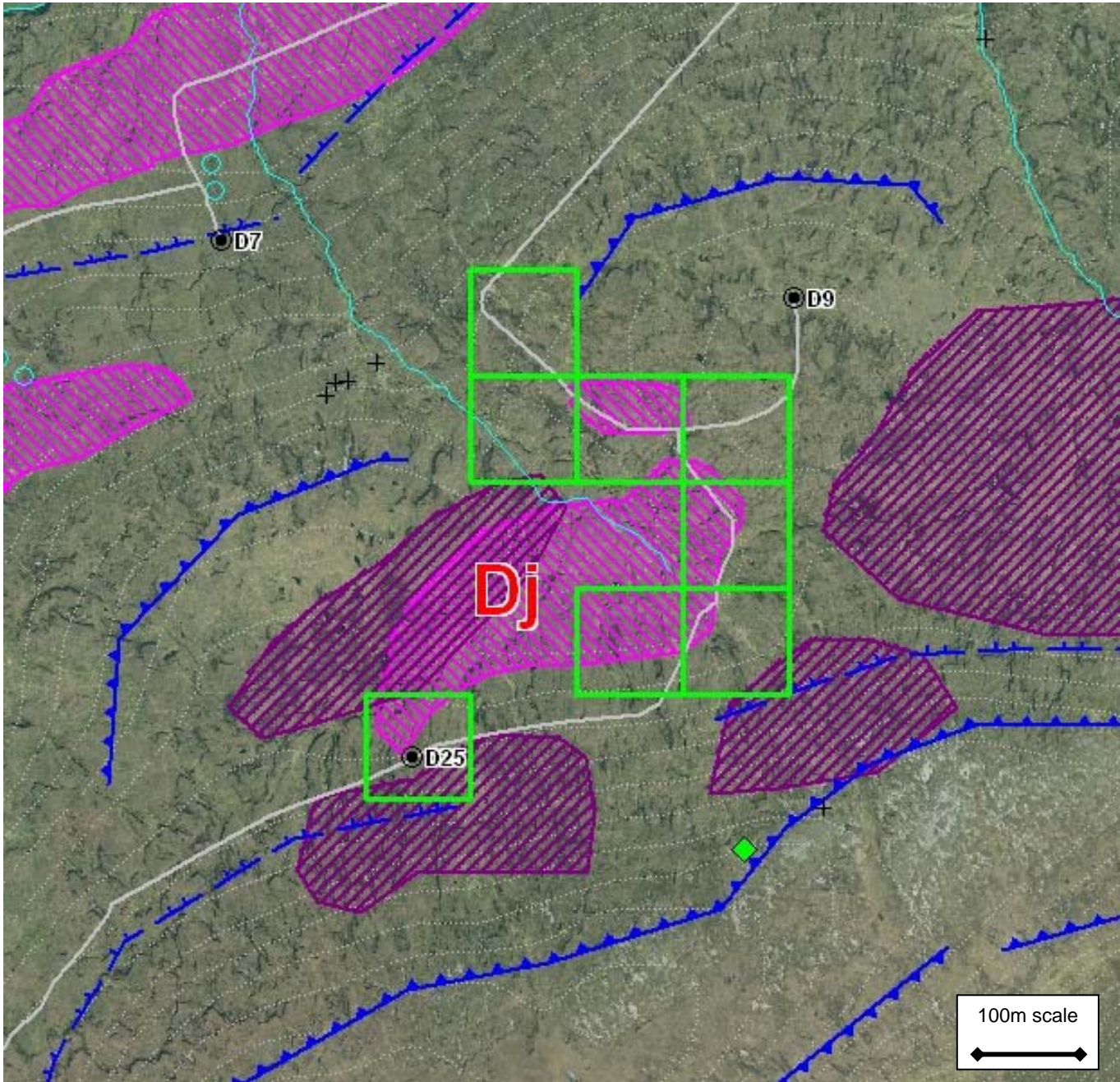
Mitigation
The degree of dissection of the peat and distance from the break in slope indicate that the risk of peat landslide is insignificant in this area; however, it may be prudent to microsite the track line south-east onto flatter ground to maximise distance from the break in slope and the watercourse channel. Risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout construction.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Dj

Grid Reference	HU 4060 7016	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 14	Depth (m)	1.95	0.5	11.03	9.92	13.95	140.4	126.4	177.4
Max. Depth (m)	3.3	Bulk Density (Mg/m³)	1.13	1.5	8.92	8.61	9.47	38.4	37.1	40.7
Min. FoS	37.1	Von Post classification	H6							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.0	Primary receptor (stream order)	Burn of Oxnabool (1)
Width (m)	530		
Down slide distance (m)	200	Secondary receptor (stream order)	Burn of Laxobigging (2)
Up slide distance (m)	220		
Volume (m³)	445,200		

**Comment / Description**

Location **Dj** forms a wide nearly flat bowl at the head of the Burn of Oxnabool. This area was visited as part of the reconnaissance survey and is documented as Area D2 in the Reconnaissance Survey section of this report. Recorded peat depths vary from 0 to 3.3m although most are between 1.5 and 2.5m. The peat in this area is quite dissected by drainage channels, with more extensive erosion in places. The preliminary assessment identified this area as a potential risk area owing to the occurrence of fairly steep slopes (up to 14°) and deep peat within the same grid cell. However, closer inspection has found that the deep peat and steep slopes are not coincident. The shear strength of the peat decreases with depth, but even the lowest measured values are sufficient to return very stable FoS values. The peat sampled in the area is strongly decomposed and has a fairly high bulk density. The track has been routed around rather than through the bowl, avoiding most of the deep peat.

**Mitigation**

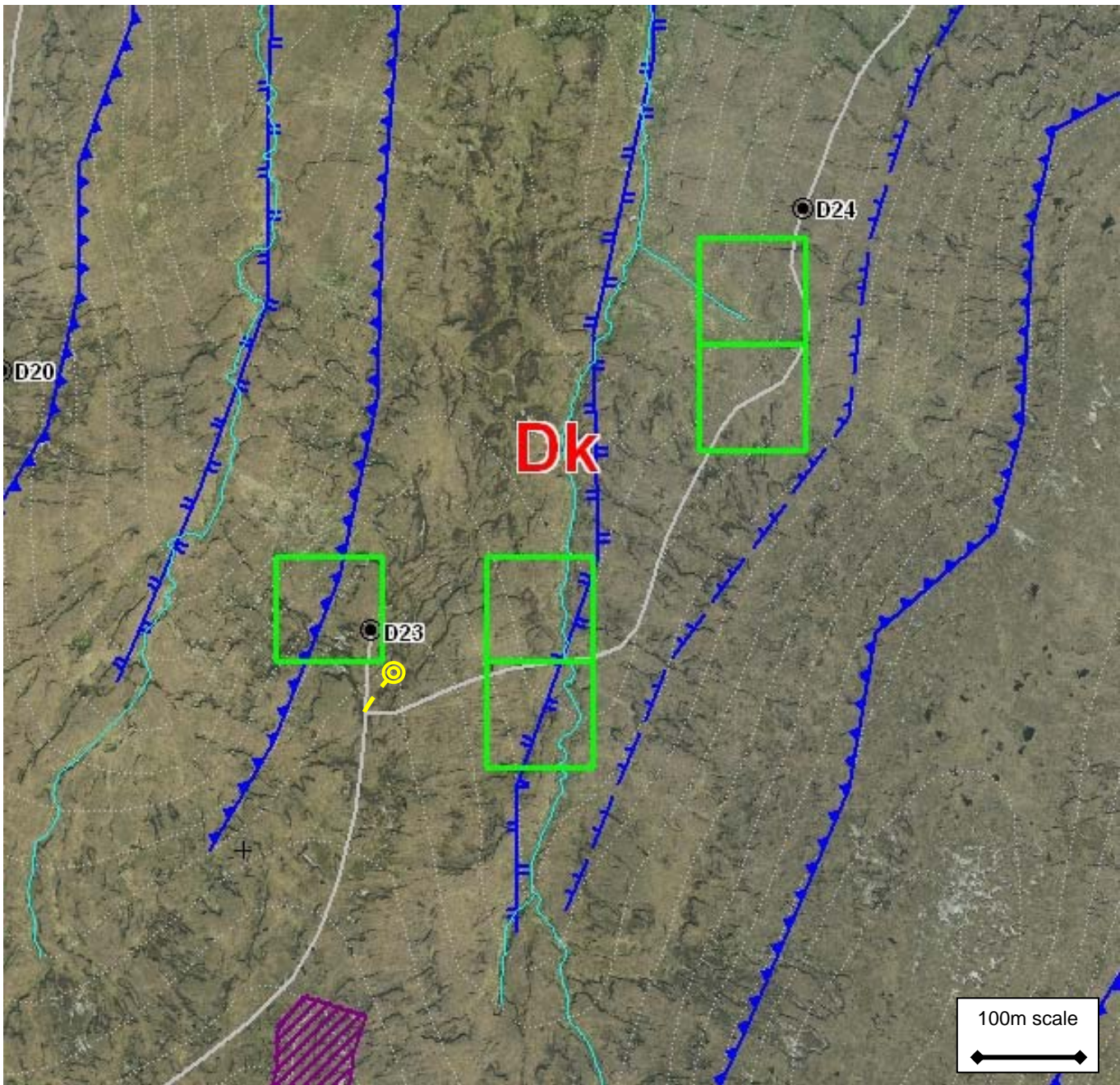
Given the very low slope angles in the areas with deep peat, and the bowl-shaped topographical setting of the site, there is little risk of peat slide. Floating track construction is recommended for the areas of deep peat and care should be taken in the track design to minimise disruption to subsurface flow in the peat. However, the risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Dk

Grid Reference	HU 3976 6917	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 17	Depth (m)	-							
Max. Depth (m)	2.3	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.9	Primary receptor (stream order)	Burn of Easterbutton (2); Burn of Westerbutton (1)
Width (m)	220		
Down slide distance (m)	180	Secondary receptor (stream order)	Burn of Laxobigging (2)
Up slide distance (m)	400		
Volume (m³)	242,400		

Comment / Description
Location <b>Dk</b> is situated around the Burn of Easterbutton valley. The valley itself is incised with a concave break in slope along the eastern valley side. Recorded peat depths range from 1.2 to 2.3m, with slope angles mostly around 7° although these steepen to 12° within the main stream valley. Although the location was highlighted by the preliminary assessment as being at risk of peat landslide through the presence of deep peat and steep slopes within each grid cell, these areas are not coincident. Much of the location is within 50m of a watercourse, excepting the westernmost section. This cell crosses a convex break in slope; however, the infrastructure all remains on the flatter slopes above the break line and peat in this area is only moderately deep.

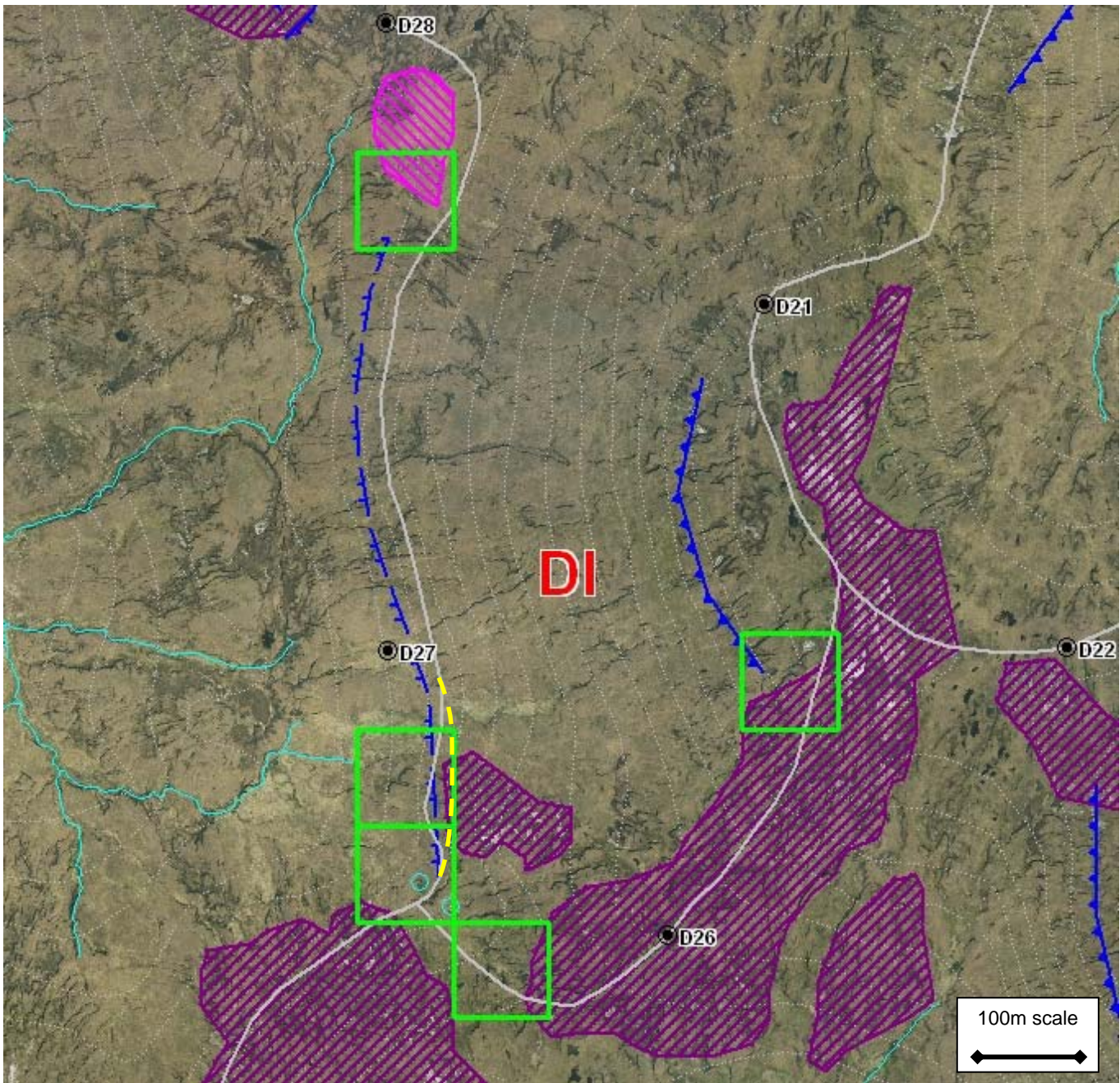
Mitigation
Whilst the risk of peat landslide is considered insignificant, it might be prudent to microsite Turbine D23 to the south-east, to increase its separation from the break in slope and locate it on a slightly gentler slope. Risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout construction.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION DI

Grid Reference	HU 3850 6830	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	1 – 14	Depth (m)	-							
Max. Depth (m)	3.4	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.9	Primary receptor (stream order)	Unnamed tributary to Burn of Valayre (1)
Width (m)	240		
Down slide distance (m)	260	Secondary receptor (stream order)	Burn of Valayre (2)
Up slide distance (m)	520		
Volume (m³)	355,700		

**Comment / Description**

Location **DI** lies on the flank of a wide hill defined above and below by breaks in slope. Part of this area was visited during the reconnaissance survey and is documented as Area D3 in the Reconnaissance Survey section of this report. Some deep peat is present, particularly at the northern end of the location, with measured peat depths ranging from 0.3 to 3.4m. Much of the southern section has undergone extensive erosion to mineral soil. Slope angles are mostly fairly moderate, although in places up to 14°, although the steeper slopes do not coincide with the areas of deep peat. In view of the extensive erosion, it is likely that some of the deep peat measurements are an artefact of the processed depth rather than the actual measured depth and that the peat is in fact thinner than recorded.

**Mitigation**

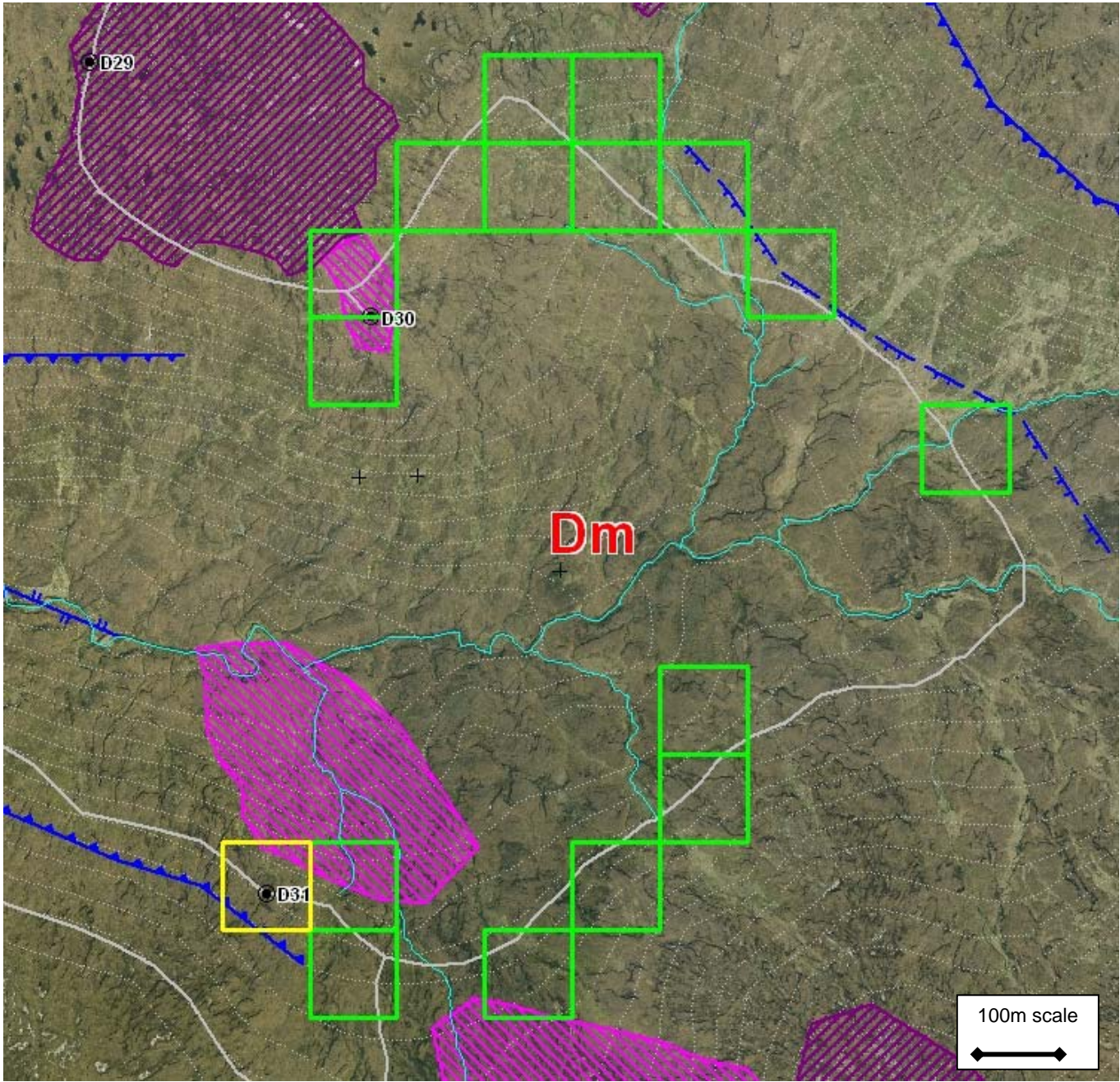
In view of the eroded nature of the peat across part of the site, and the separation between steep slopes and deep peat, the risk of peat landslide is considered to be insignificant and therefore no mitigation is necessary. It may be prudent to microsite part of the track in the southern section uphill to minimise crossing the break in slope and to take advantage of the area of eroded peat. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	2	Low Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Dm

Grid Reference	HU 3888 6790	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 24	Depth (m)	0.85	0.5	21.91	13.83	15.11	31.4	19.8	21.6
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	0.91							
Min. FoS	19.8	Von Post classification	H4-H5							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.7	Primary receptor (stream order)	Unnamed tributaries to Burn of Skelladale (1)
Width (m)	760		
Down slide distance (m)	550	Secondary receptor (stream order)	Burn of Skelladale (3)
Up slide distance (m)	300		
Volume (m³)	1,098,000		

Comment / Description
Location <b>Dm</b> is a wide, shallow bowl at the head of the Burn of Skelladale. This area was visited during the reconnaissance survey and is documented as Area D4 in the Reconnaissance Survey section of this report. Measured peat depths in the area vary between 0.1 and >4m, although most peat is between 1 and 2.5m deep. Slope angles range up to 24°. This area was highlighted as having a risk of peat slide in the preliminary assessment owing to the occurrence of deep peat and steep slopes in a single grid cell. However, closer inspection indicates that the deep peat and steep slopes are not coincident. Although the measured shear strengths are variable, all return FoS values that indicate a very stable slope. Von Post classification indicates that peat is weakly to moderately decomposed. Peat surface is quite dissected in places, with erosion channels cut down to mineral soil; this is particularly the case around the south side of the area. The minimum FoS value indicates that there is negligible risk of peat slide in this area.

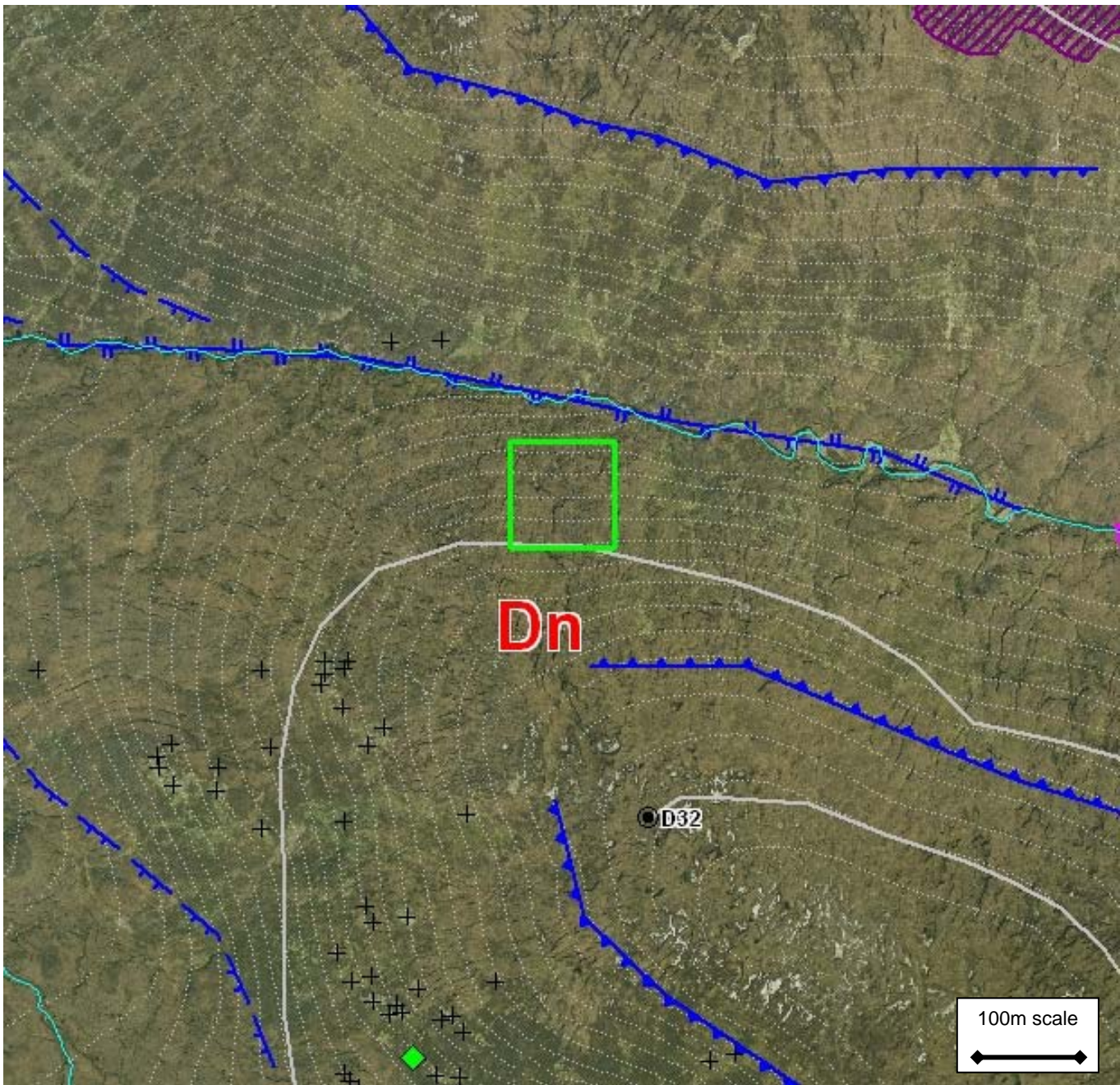
Mitigation
From a stability perspective, no mitigation is necessary as results from the GI work indicate that the peat in this area is stable. However, the risk should continue to be re-appraised throughout detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	3	High Impact	12	Substantial
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Dn

Grid Reference	HU 3785 6745	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	9 – 17	Depth (m)	-							
Max. Depth (m)	1.7	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.0	Primary receptor (stream order)	Burn of Skelladale (3)
Width (m)	100		
Down slide distance (m)	140	Secondary receptor (stream order)	A970
Up slide distance (m)	220		
Volume (m³)	36,000		

**Comment / Description**

Location **Dn** is situated on the side of a fairly steep slope above the Burn of Skelladale, which is incised and cut to bedrock along much of its length. Peat in this area is fairly moderate, between 0.6 and 1.7m in depth, but slope angles are comparatively high, between 9 and 17°. The preliminary assessment identified the location as a potential risk area owing to the occurrence of moderately deep peat and steep slopes within the same grid cell. However, closer inspection confirms that these are not coincident. There is just one measurement of moderate peat, suggesting it forms a localised pocket that is not laterally extensive. Ground conditions at Location Dn were found to be dry and firm underfoot with a good coverage of heather.

**Mitigation**

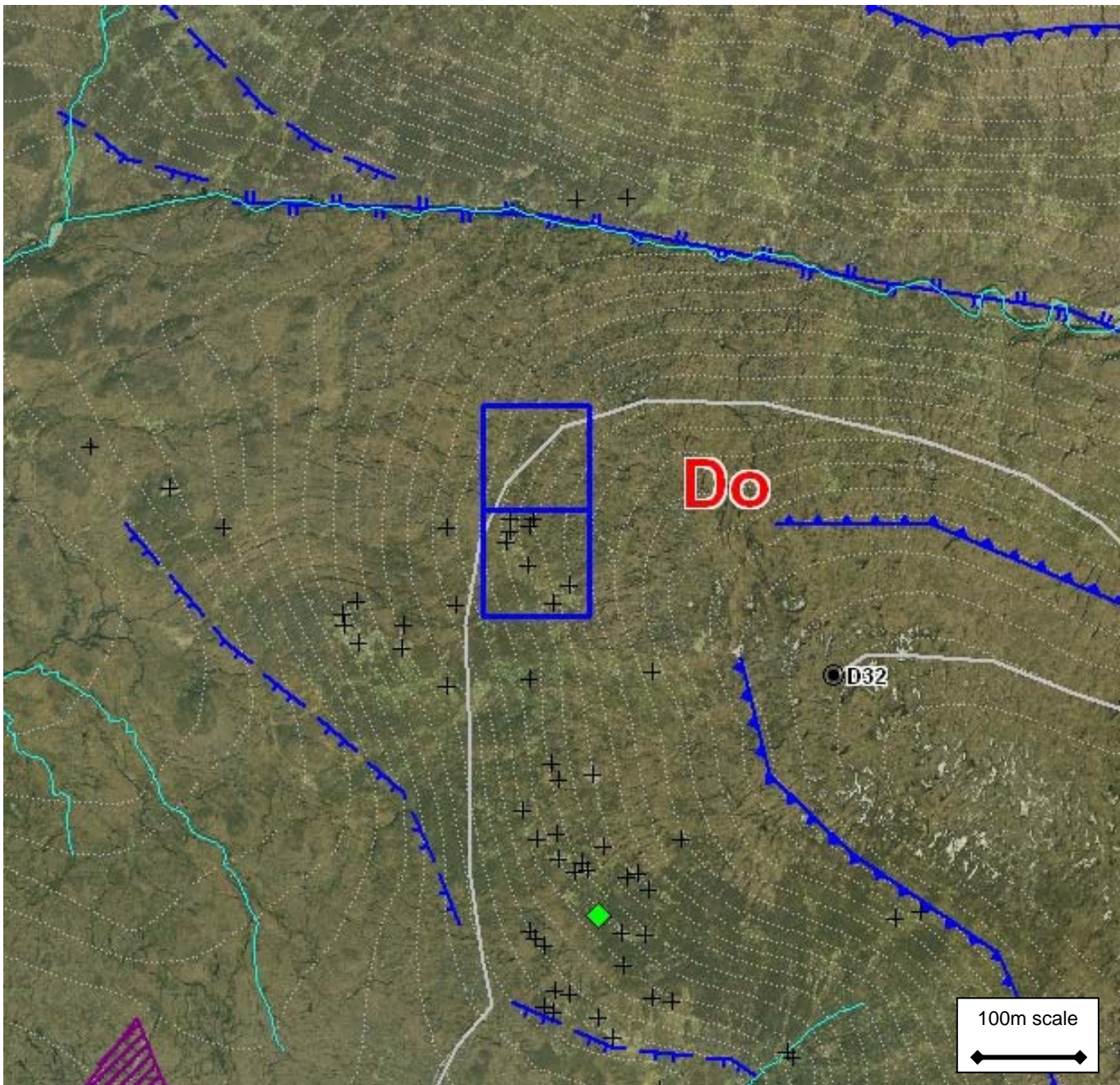
It is recommended that the track route is microsituated to the south in order to take advantage of gentler slope angles and to avoid the localised pocket of deeper peat. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Do (control)

Grid Reference	HU 3761 6730	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	5 – 23	Depth (m)	0.75	0.5	8.01	29.42	16.92	6.8	25.0	14.4
Max. Depth (m)	1.0	Bulk Density (Mg/m³)	1.13							
Min. FoS	6.8	Von Post classification	H4							



Estimated Peat Slide Parameters

Estimated average peat depth (m)		Primary receptor (stream order)	
Width (m)			
Down slide distance (m)		Secondary receptor (stream order)	
Up slide distance (m)			
Volume (m³)			

Comment / Description

Location **Do** is situated on the side of a hill with variable slope angles, which slacken off both above and below the track alignment. Measured peat depths are up to 0.9m. The southern part of the area has some scattered bedrock exposure which becomes more extensive further to the south. There are no watercourses within 150m of the location. Peat at this site was found to be fairly dry and only weakly decomposed, probably related to the shallow peat depth. Shear strength values were found to be quite variable but all returned high FoS values, indicating that the slope is stable.

Mitigation

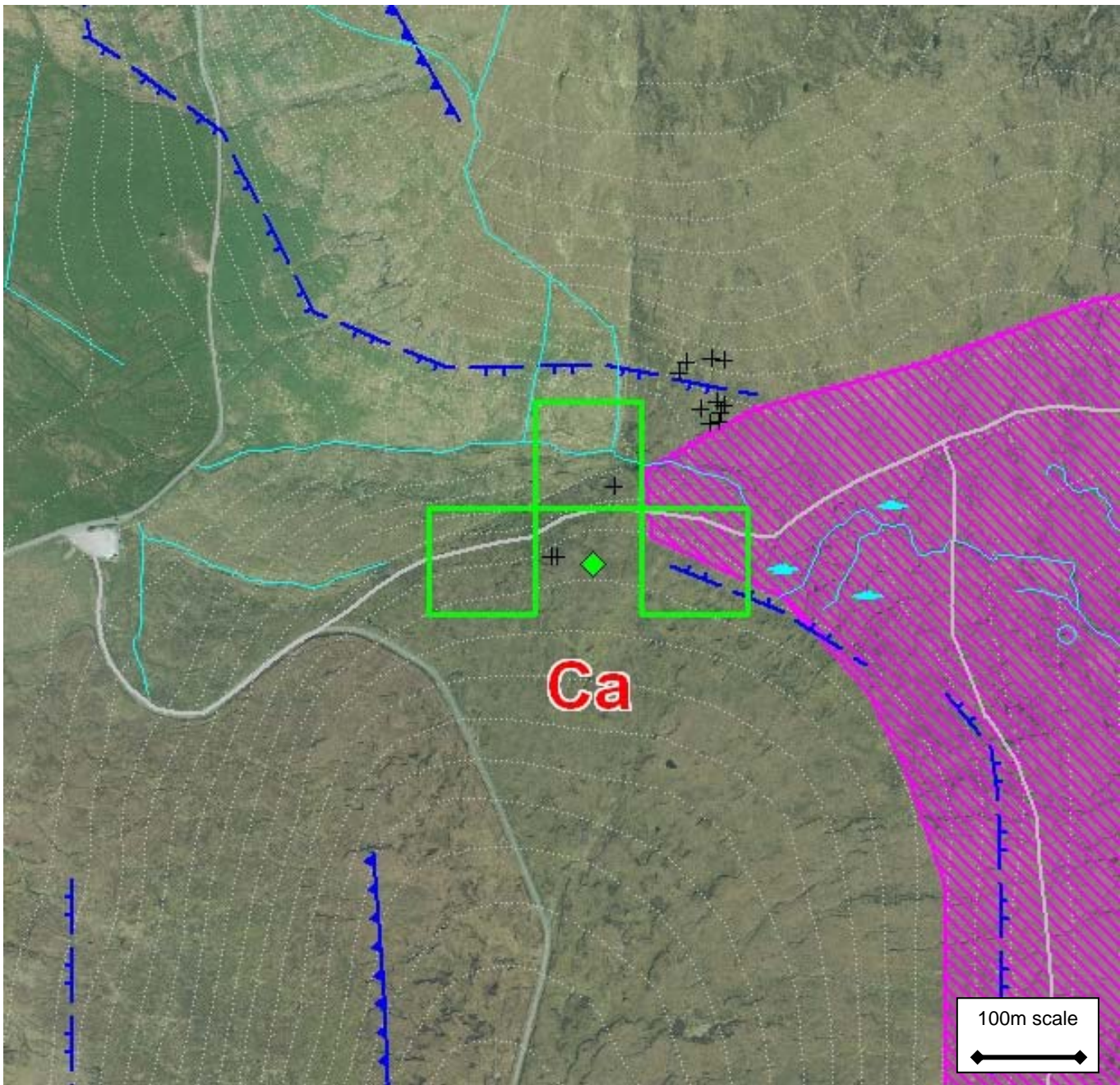
Risk of peat slide is insignificant, therefore no mitigation is necessary. Risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken across the site by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	2	Low Impact	4	Insignificant
Final	1	Negligible	2	Low Impact	2	Insignificant



LOCATION Ca

Grid Reference	HU 4175 6610	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 10	Depth (m)	0.65	0.5	33.47	24.88	23.62	82.3	61.2	58.1
Max. Depth (m)	3.8	Bulk Density (Mg/m³)	1.05	1.5	4.08	3.27	23.82	3.4	2.7	19.6
Min. FoS	2.7	Von Post classification	H2	2.5	11.26	6.95	9.39	5.6	3.5	4.7



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.1	Primary receptor (stream order)	Unnamed tributary to Burn of Sandgarth (1)
Width (m)	310		
Down slide distance (m)	100	Secondary receptor (stream order)	Minor road
Up slide distance (m)	100		
Volume (m³)	130,200		

**Comment / Description**

Location **Ca** lies on the western side of a distinct col, adjacent to the headwaters of a small watercourse. The watercourse has been heavily modified for drainage purposes along much of its length. The eastern end of the location coincides with a large area of deep peat extending from the flat part of the col through into the Seggie Burn valley. The preliminary assessment identified the location as a potential risk area owing to the occurrence of moderate or deep peat and steep slopes within the same grid cell. However, closer inspection confirms that these are not coincident. The northern part of the location has been modified for agricultural purposes and is unlikely to be underlain by peat of greater than 0.5m. Although the measured shear strengths are variable, all return FoS values that indicate a stable slope. Von Post classification indicates that peat is almost undecomposed. The minimum FoS value indicates that there is negligible risk of peat slide in this area.

**Mitigation**

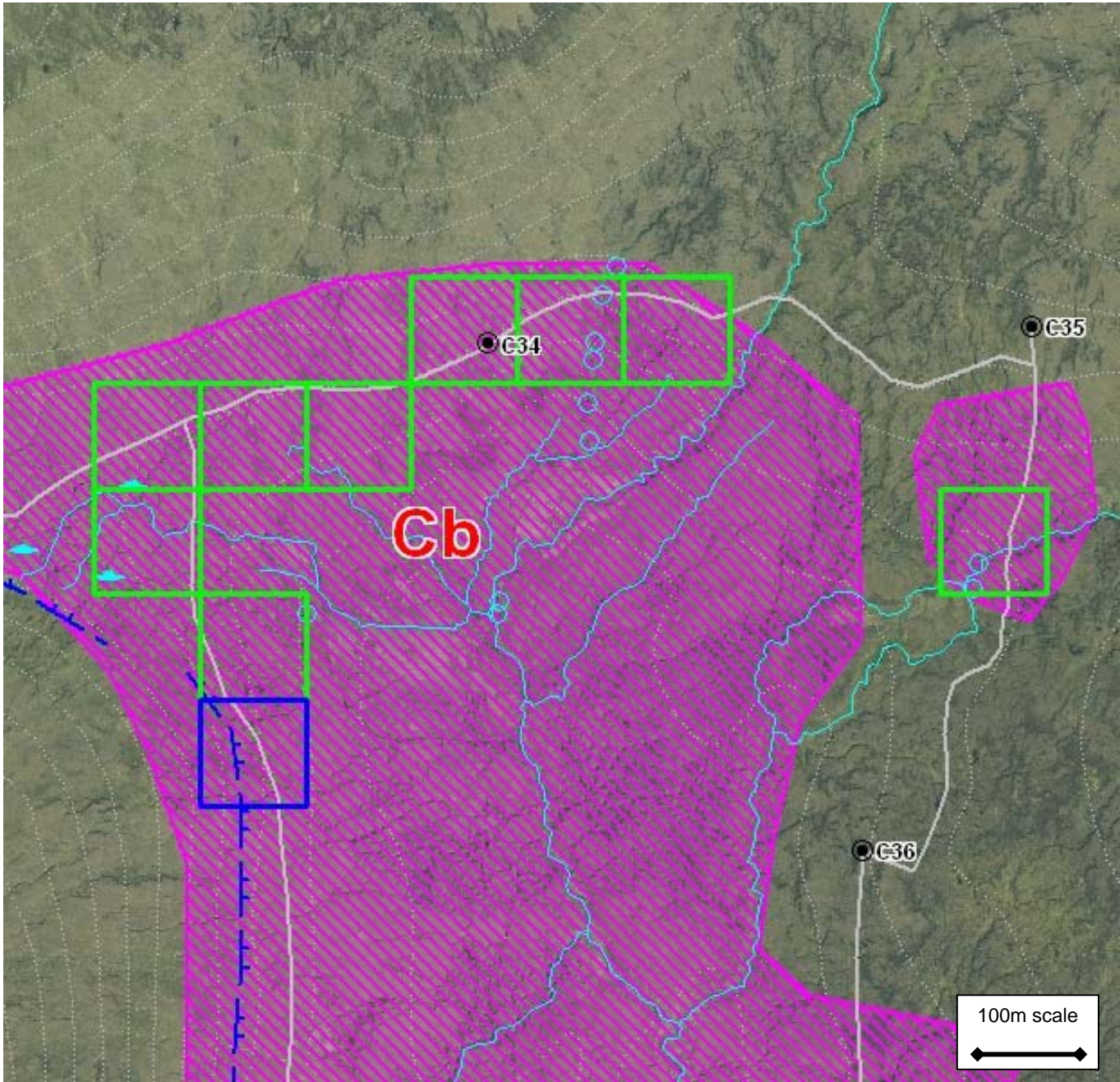
Modification of the watercourse indicates it is less susceptible to impact than a fully natural watercourse. GI results and analysis indicate that the risk of peat landslide is insignificant so there is therefore no requirement for mitigation. However, the risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	2	Low Impact	2	Insignificant



**LOCATION Cb** (please note that GI results for locations Cb and Cc are identical; this GI site is adjacent to the two areas and equally applicable to both locations)

Grid Reference	HU 4225 6615	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 14	Depth (m)	1.95	0.5	24.78	30.12	31.41	30.2	36.6	38.2
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	1.21	1.5	23.82	13.25	17.83	9.7	5.5	7.3
Min. FoS	5.5	Von Post classification	H6							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	3.0	Primary receptor (stream order)	Unnamed tributary to Seggie Burn (1)
Width (m)	580		
Down slide distance (m)	150	Secondary receptor (stream order)	Seggie Burn (3)
Up slide distance (m)	310		
Volume (m³)	800,400		

**Comment / Description**

Location **Cb** is situated around the northern part of the Seggie Burn valley. This area was visited during the reconnaissance survey and is documented as Area C1 in the Reconnaissance Survey section of this report. Most of the location has deep peat, with measured depths ranging from 1.6 to >4m. The boggy area around the col to the west mostly has peat deeper than 4m. The preliminary assessment identified the location as a potential risk area owing to the occurrence of deep peat and moderately steep slopes within the same grid cell. However, closer inspection confirms that these are not coincident. Measured shear strengths from adjacent to the location are fairly high and all return FoS values that indicate a stable slope. Von Post classification indicates that peat is strongly decomposed. The minimum FoS value indicates that there is negligible risk of peat slide in this area. A large partially collapsed peat pipe is visible in the central northern part of the site.

**Mitigation**

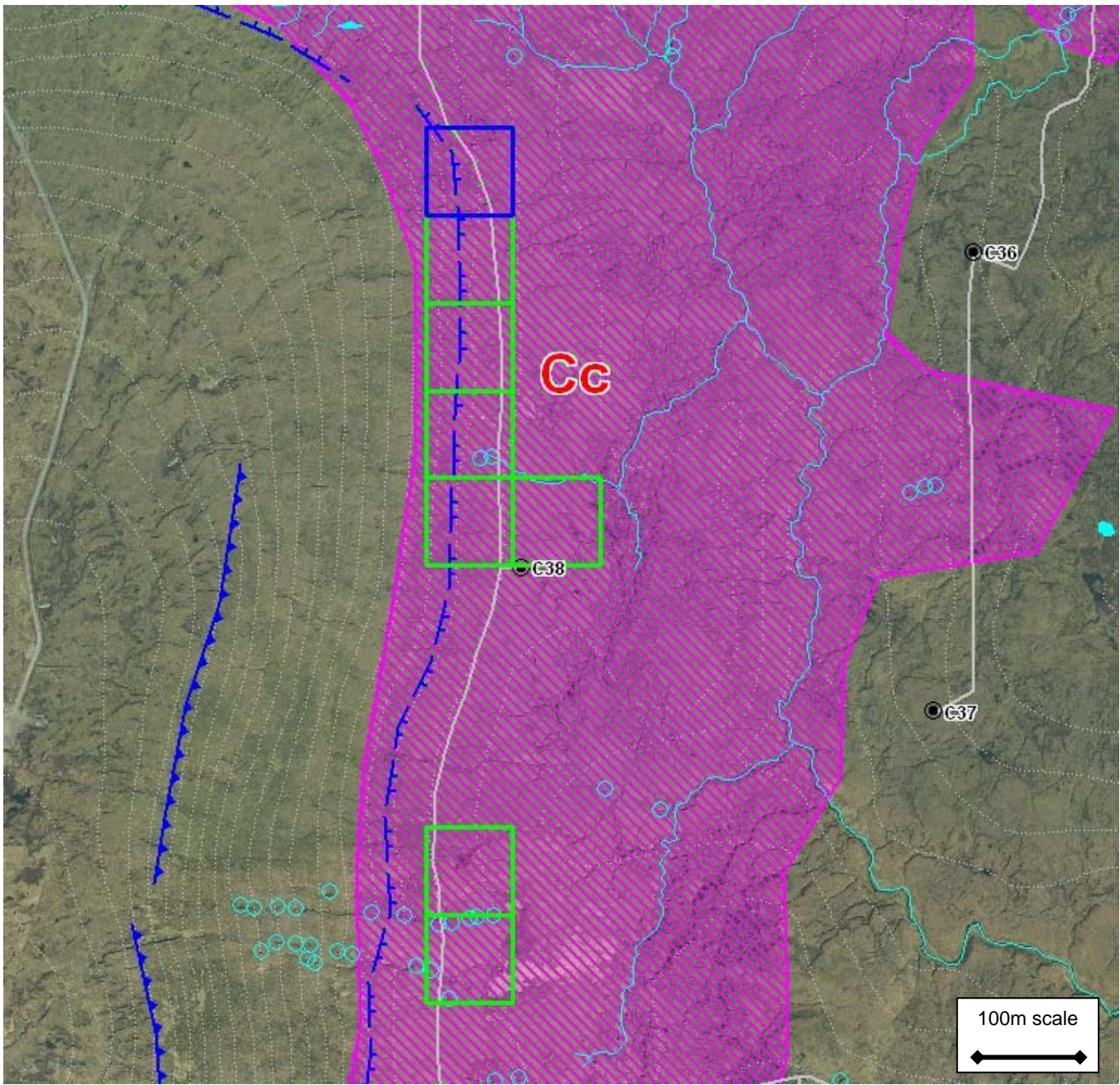
It is recommended that floating track construction is used across deep peat areas. Attention will be required in the track design to avoid disruption of subsurface flow within the peat. The track line around the peat pipe should be micrositied south of its current position to an area where the watercourse is overground to minimise the risk of further pipe collapse. Risks should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



**LOCATION Cc** (please note that GI results for locations Cb and Cc are identical; this GI site is adjacent to the two areas and equally applicable to both locations)

Grid Reference	HU 4219 6564	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 13	Depth (m)	1.95	0.5	24.78	30.12	31.41	30.2	36.6	38.2
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	1.21	1.5	23.82	13.25	17.83	9.7	5.5	7.3
Min. FoS	5.5	Von Post classification	H6							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.9	Primary receptor (stream order)	Unnamed tributary to Seggie Burn (1)
Width (m)	400		
Down slide distance (m)	280	Secondary receptor (stream order)	Seggie Burn (3)
Up slide distance (m)	350		
Volume (m³)	730,800		

**Comment / Description**

Location **Cc** lies along the western side of the Seggie Burn valley, which is demarcated by a distinct concave break in slope. Below this, slope angles are in the range 4-7° whilst above the break in slope angles increase to 12-15°. This area was visited as part of the reconnaissance survey and is documented as Area C2 in the Reconnaissance Survey section of this report. The location is almost entirely within deep peat, predominantly in excess of 2.5m and in some areas in excess of 4m. Occasional shallow areas have been recorded. Several partially collapsed peat pipes were observed, particularly towards the southern part of the location, and other pipes may be present. Measured shear strengths from adjacent to the location are fairly high and all return FoS values that indicate a stable slope. Von Post classification indicates that peat is strongly decomposed. The minimum FoS value indicates that there is negligible risk of peat slide in this area.

**Mitigation**

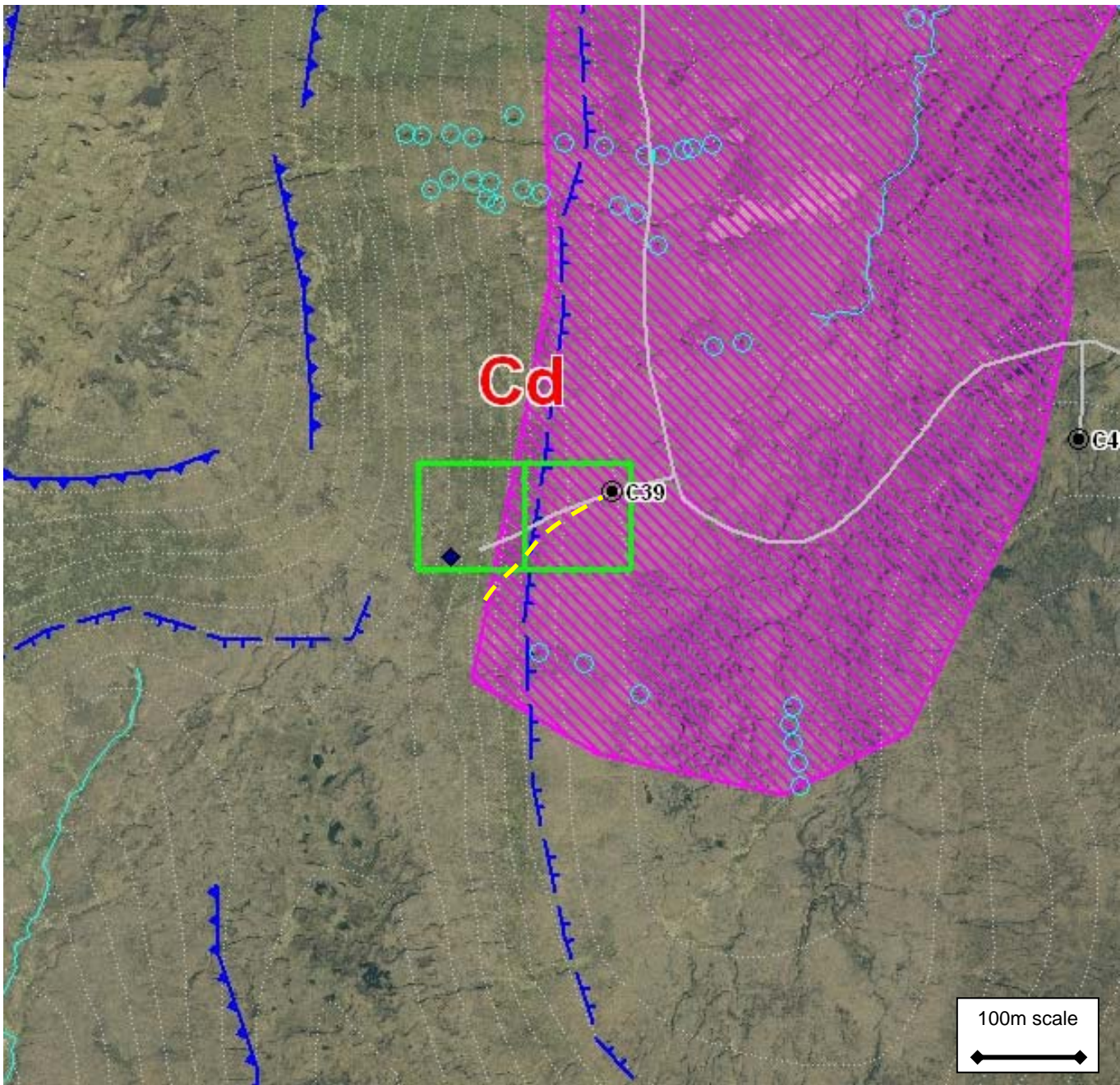
Floating track construction is recommended for this location as most of the peat is deep or very deep. Attention will be required in the track design to avoid disruption of subsurface flow within the peat. Care should be taken to verify locations of peat pipes prior to construction and to maintain their stability. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Cd

Grid Reference	HU 4200 6465	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	3 – 23	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	3.0	Primary receptor (stream order)	Unnamed tributary to Seggie Burn (1)
Width (m)	70		
Down slide distance (m)	270	Secondary receptor (stream order)	Seggie Burn (3)
Up slide distance (m)	370		
Volume (m³)	134,400		

Comment / Description
Location <b>Cd</b> is also situated across the concave break in slope at the eastern side of the Seggie Burn valley. Below the break in slope, slope angles are mostly in the range 4-6°, whilst above this the angles steepen to 12° and steeper. A narrow crack was observed towards the western side of this location, running parallel to the contours for a distance of approximately 15m both north and south. Measured peat depth beside the crack was 0.9m. Below the break in slope the recorded peat depths are mostly in excess of 4m. The area was observed to have a number of semi-circular hollows in the hillside, typical of eroding peat banks on steep slopes. No drainage channels or other signs of instability were visible.

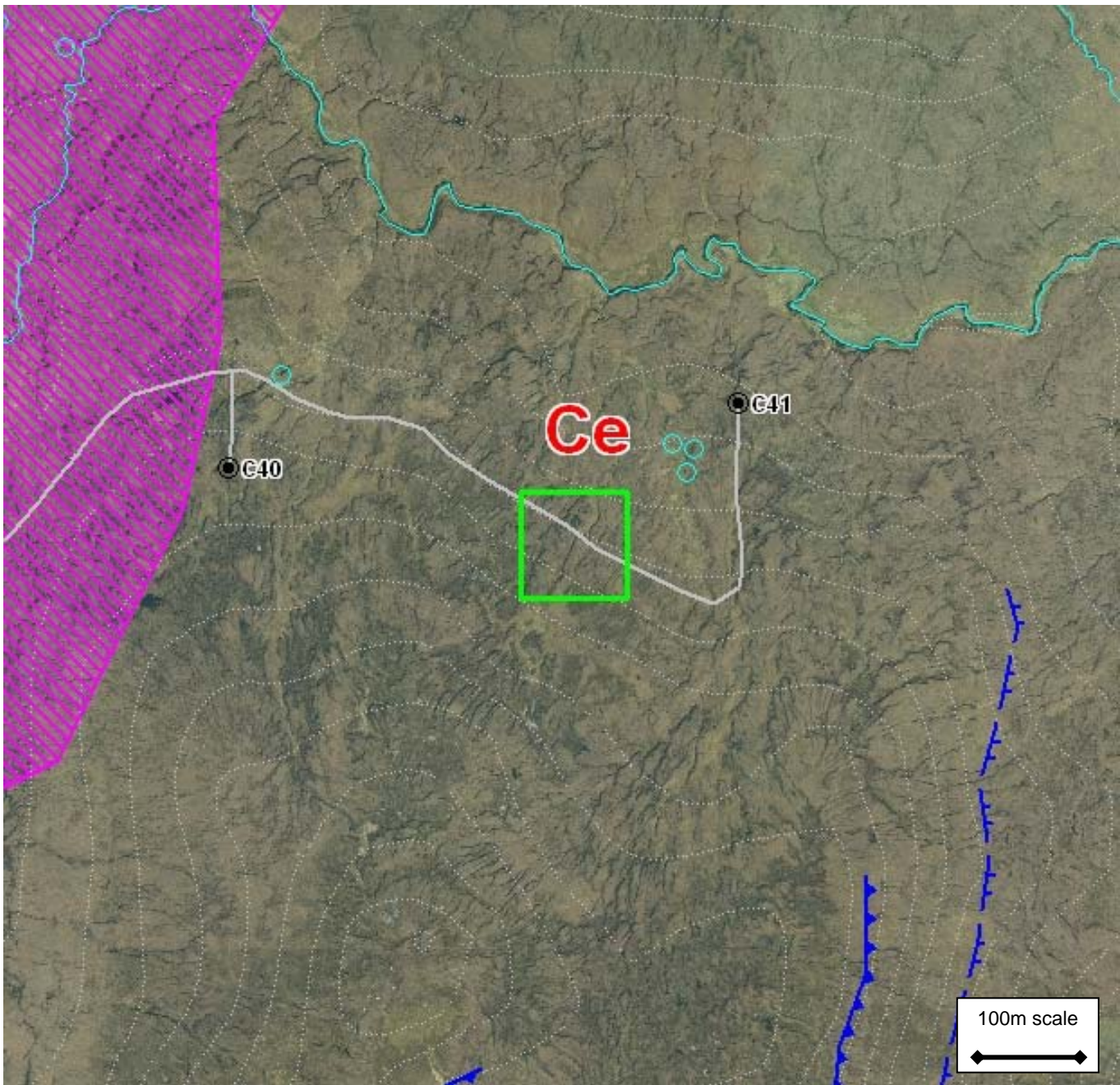
Mitigation
Floating track construction is recommended for this location as most of the peat is deep or very deep. Attention will be required in the track design to avoid disruption of subsurface flow within the peat. It is recommended that the anemometer and track line are micro-sited south to avoid the area with observed cracks and to take advantage of lower slope angles. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Ce

Grid Reference	HU 4285 6465	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	3 – 9	Depth (m)	-							
Max. Depth (m)	3.2	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.8	Primary receptor (stream order)	Seggie Burn (3)
Width (m)	120		
Down slide distance (m)	250	Secondary receptor (stream order)	B9071
Up slide distance (m)	380		
Volume (m³)	136,100		

Comment / Description
Location <b>Ce</b> is situated on the southern side of the Seggie Burn, where its valley becomes better defined. The area is characterised by deep drainage channels and gullies in the peat. Peat depths are mostly moderate, less than 1.8m, although one measured point is 3.2m deep. Slope angles are moderate, ranging between 3 and 9°. The conditions were dry underfoot, owing in part to the dissected nature of the peat and the number of drainage channels promoting rapid runoff. The single deep peat measurement suggests a small pocket of deeper peat confined in an area of mainly shallow to moderate peat. No signs of instability were observed in the area.

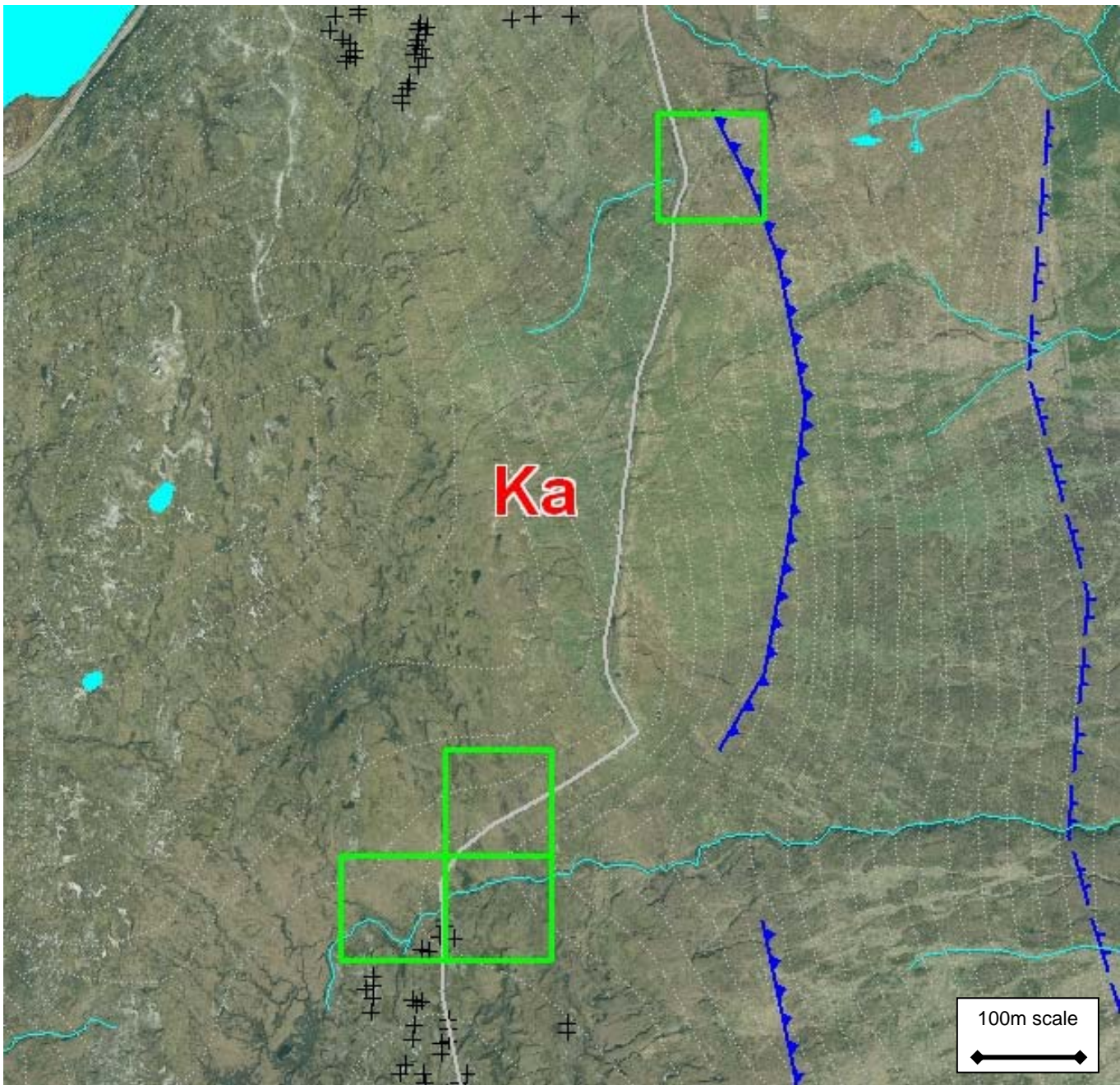
Mitigation
As the deep peat has very limited occurrence and is likely to represent a confined pocket of deeper peat, it is concluded that the risk of peat landslide is insignificant in this location. Micrositing of the track to avoid the area of deep peat may be required. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	2	Low Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Ka

Grid Reference	HU 3916 6173	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 33	Depth (m)	-							
Max. Depth (m)	2.5	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	0.9	Primary receptor (stream order)	Unnamed tributaries to Burn of Kirkhouse (2)
Width (m)	210		
Down slide distance (m)	120	Secondary receptor (stream order)	Burn of Kirkhouse (4)
Up slide distance (m)	310		
Volume (m³)	81,300		

**Comment / Description**

Location **Ka** lies on an east-facing slope with variable slope angles. The northern part of the location has steep slopes up to 33°; measured peat depths in this area are shallow, all less than 0.5m, and the track line lies along an existing track. The southern part of the location has slope angles up to 14° and measured peat depths of 0.1 to 2.5m. Most of the depth measurements are less than 1.2m with only one small area of deeper peat. This area was flagged by the preliminary assessment as a potential risk area owing to the occurrence of deep peat and moderately steep slopes within the same grid cell. However, closer inspection confirms that these are not coincident.

**Mitigation**

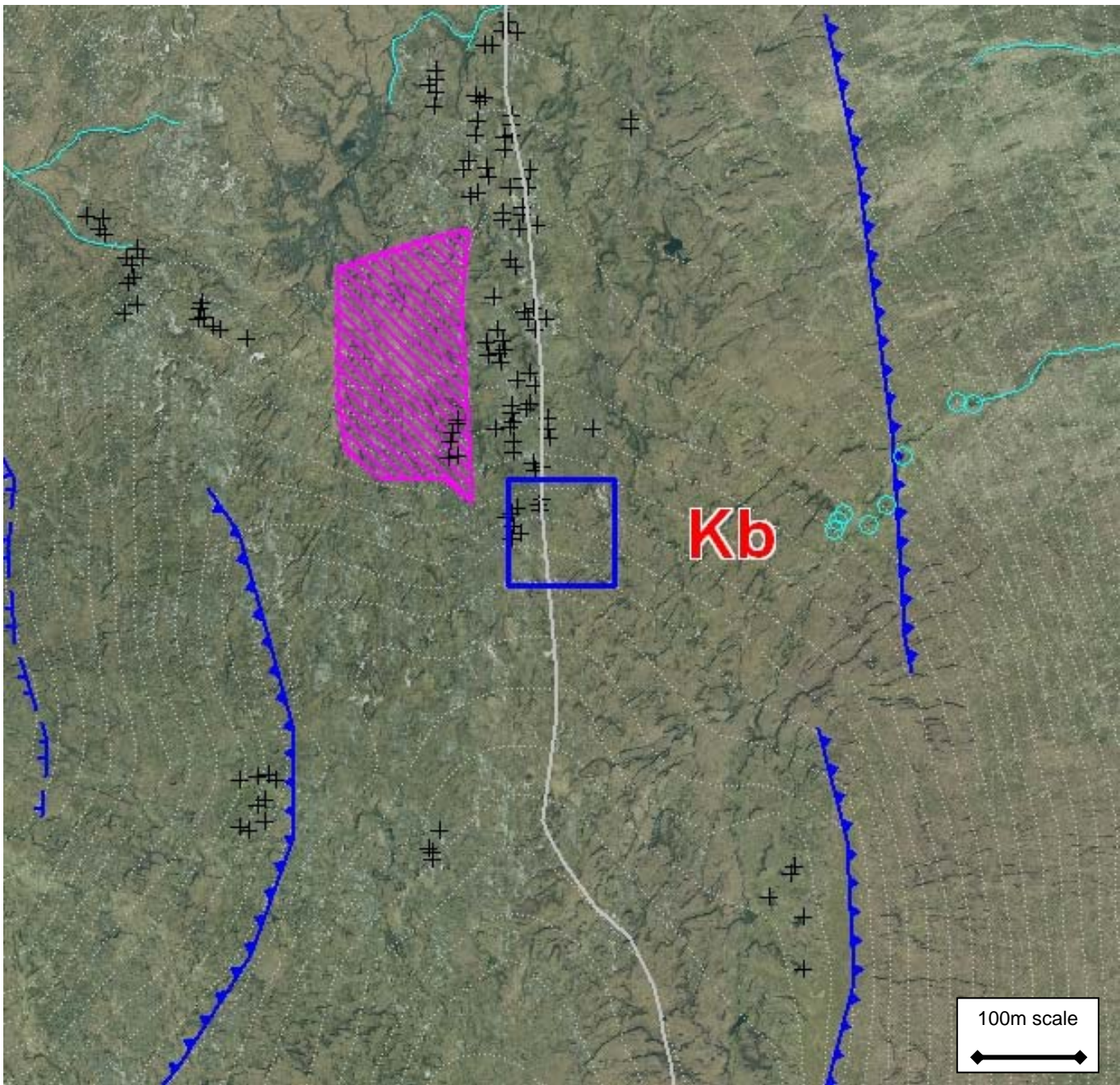
From a stability perspective, no mitigation is necessary as the peat landslide risk has been assessed as insignificant. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Kb (control)

Grid Reference	HU 3903 6084	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	2 – 24	Depth (m)	0.25	0.5	29.42	36.11	24.38	65.0	79.9	53.9
Max. Depth (m)	1.0	Bulk Density (Mg/m³)	0.81							
Min. FoS	53.9	Von Post classification	H4							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)		Primary receptor (stream order)	
Width (m)			
Down slide distance (m)		Secondary receptor (stream order)	
Up slide distance (m)			
Volume (m³)			

**Comment / Description**

Location **Kb** is situated on the upper part of a rocky ridge. Rock outcrop is quite frequent, especially at lower levels and to the west of the track alignment. Slope angles at the location range from 2 to 24°; the steeper slopes coincide with the rocky outcrop. Measured peat depths are shallow, reaching a maximum of 1m and mostly less than 0.2m. Shear strengths measured at the location are high, giving very high FoS values indicating a very stable slope. Von Post classification indicates that the peat is weakly decomposed. The low bulk density is typical of acrotelmic peat with a high plant fibre content.

**Mitigation**

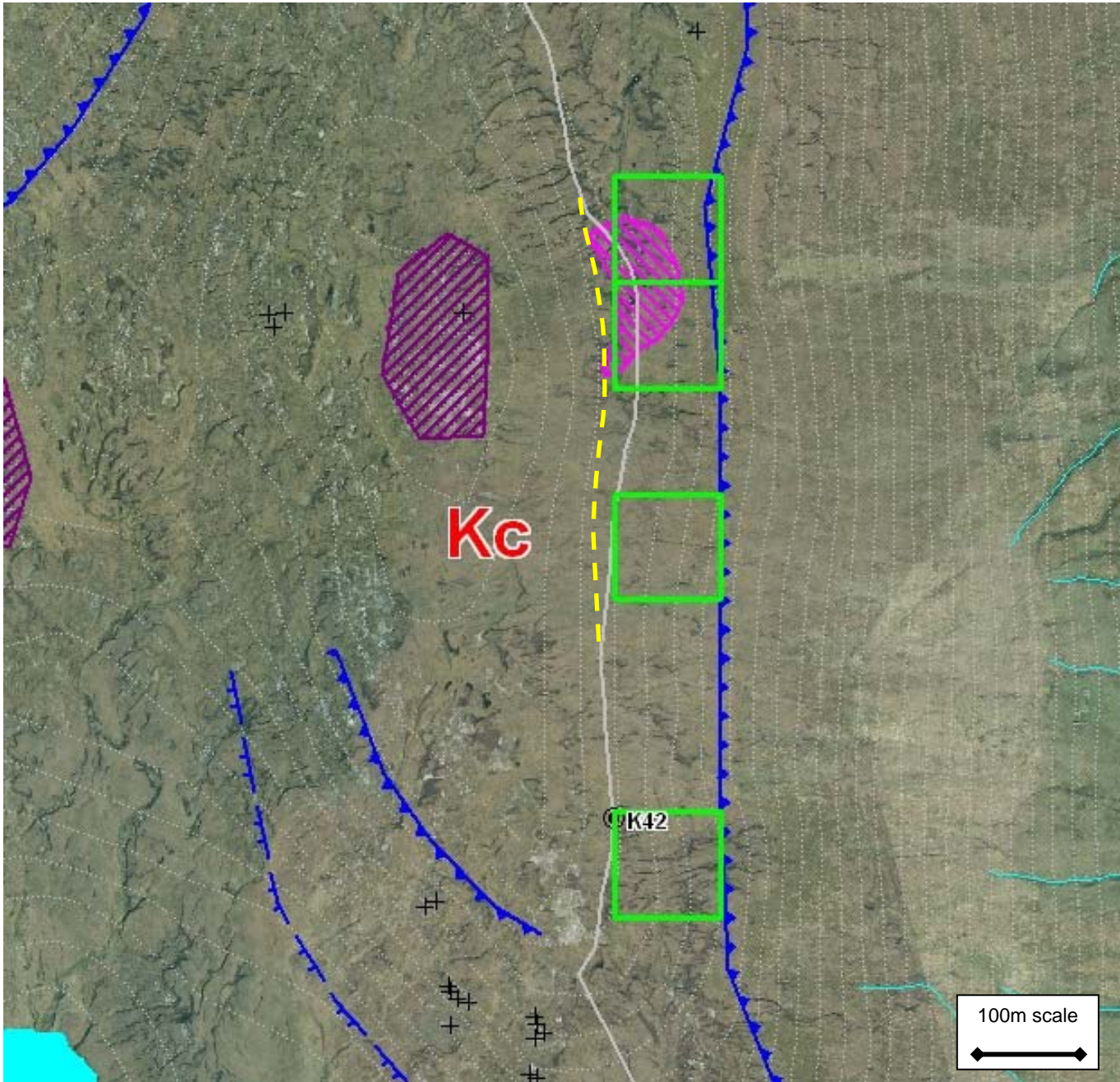
As the risk of peat landslide is insignificant there is no mitigation necessary. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	1	Very Low Impact	2	Insignificant
Final	1	Negligible	1	Very Low Impact	1	Insignificant



LOCATION Kc

Grid Reference	HU 3920 5995	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 26	Depth (m)	-							
Max. Depth (m)	3.6	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2	Primary receptor (stream order)	Unnamed tributaries to Burn of Kirkhouse / Burn of Kergord (1)
Width (m)	140		
Down slide distance (m)	590	Secondary receptor (stream order)	Burn of Kirkhouse (3) / Burn of Kergord (3)
Up slide distance (m)	100		
Volume (m³)	193,200		

Comment / Description
Location <b>Kc</b> lies along the side of a ridge just above a convex break in slope. Slope angles are around 8° above the break in slope, steepening to 15° or more below. The proposed track line is at least 70m distant from the break in slope. Peat depths range between 1.2 and 3.6m. Preliminary assessment highlighted this area as a potential risk location owing to the steep slopes and deep peat within a single grid cell. Detailed inspection indicated that they are not coincident, with the steep slopes lying below the break in slope and the deep peat above and set back from this. The peat at this location is quite eroded, to mineral soil in the gullies, but no signs of instability were observed. Ground conditions were dry underfoot.

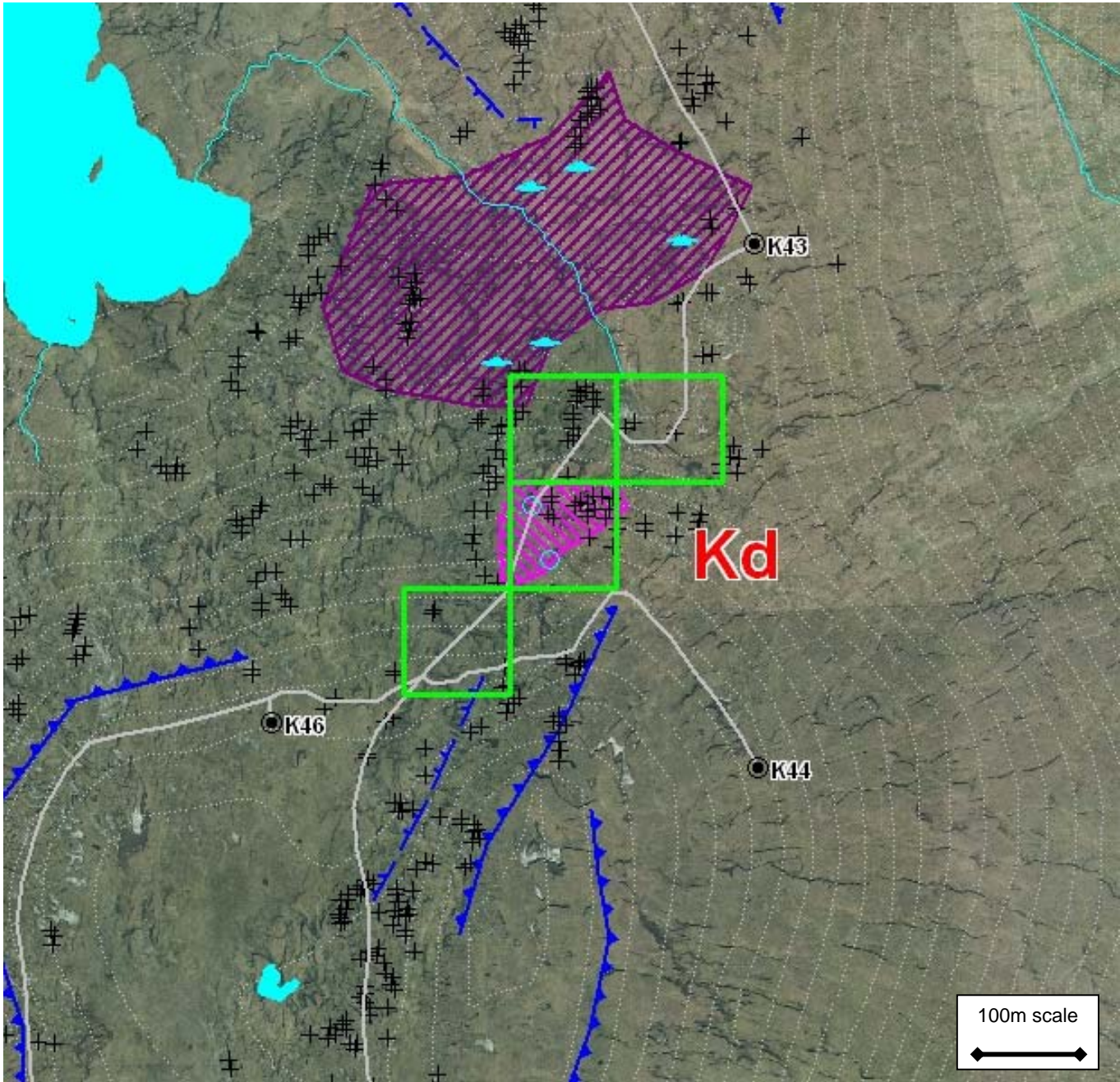
Mitigation
Whilst the risk of peat landslide is insignificant it may be prudent to microsite the track a little further uphill to the west, to avoid the deeper peat and to take advantage of shallower slope angles. It is recommended that Turbine K42 is microsite south-west away from the identified risk area. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Kd

Grid Reference	HU 3915 5900	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 28	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.7	Primary receptor (stream order)	Unnamed tributary to Marrofield Water (1)
Width (m)	300		
Down slide distance (m)	200	Secondary receptor (stream order)	Marrofield Water
Up slide distance (m)	260		
Volume (m³)	234,600		

**Comment / Description**

Location **Kd** is situated on the south side of a narrow rocky col. This area was visited as part of the reconnaissance survey and is documented as Area K1 in the Reconnaissance Survey section of this report. Within the col itself the peat has been subject to considerable erosion and gullyng. Slope angles across the location are variable, reflecting the varied character of the location. Rock steps and outcrop areas coincide in the main with the steep slope angles. Some areas of deep peat were recorded but these tend to form small, mostly confined, pockets of deeper peat. A small collapsed peat pipe was observed in one peat pocket.

**Mitigation**

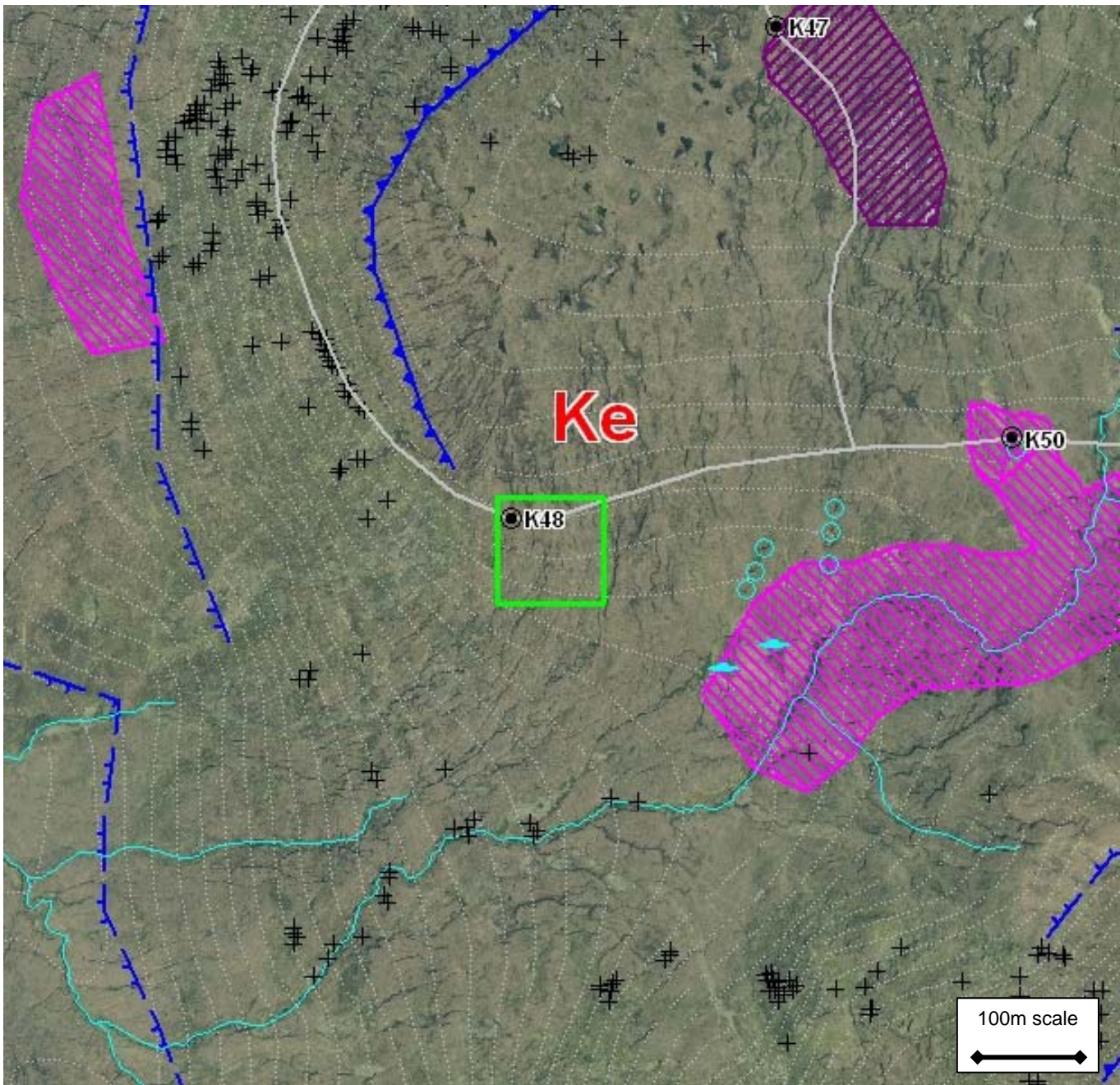
Owing to the widespread occurrence of rock outcrop this location has been assessed as having insignificant risk of peat landslide hazard, and consequently no mitigation is required. Floating track construction may be necessary across the identified section of deep peat. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Ke

Grid Reference	HU 3834 5774	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	6 – 12	Depth (m)	-							
Max. Depth (m)	2.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.5	Primary receptor (stream order)	Unnamed tributary to Burn of Lunklet (1)
Width (m)	100		
Down slide distance (m)	520	Secondary receptor (stream order)	Burn of Lunklet (3)
Up slide distance (m)	240		
Volume (m³)	114,000		

Comment / Description
Location <b>Ke</b> lies on the southern flank of a wide hill, near a prominent concave break in slope. Slope angles within the location are fairly modest, being mostly 6.5 to 8.5° but steepening to 12° in the lower part of the cell. Measured peat depths are also variable, ranging between 0.5 and 2m. No signs of instability were observed during site visits. Peat is mostly fairly intact although some minor gullyng was observed in the northern part of the location.

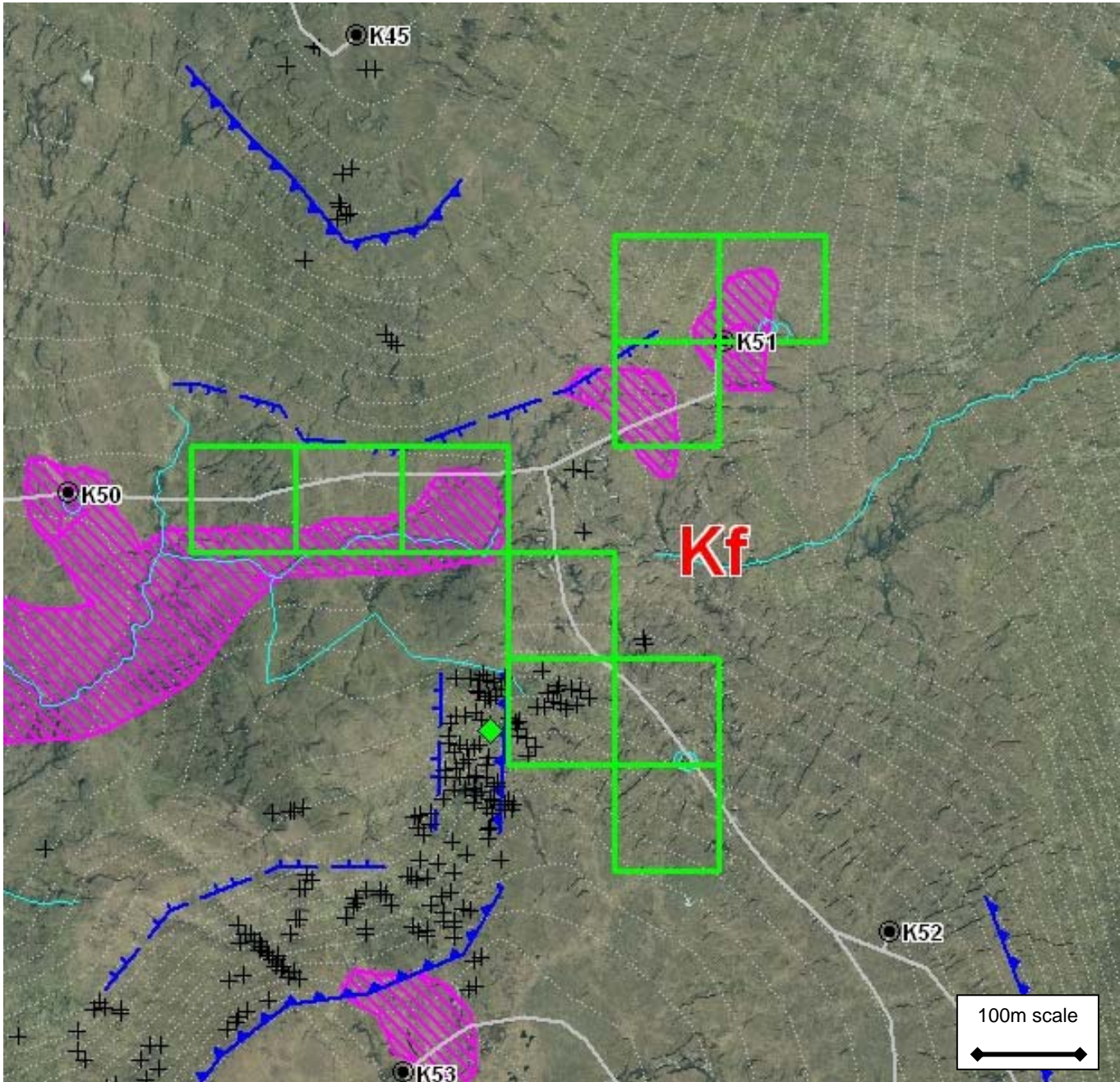
Mitigation
From a stability perspective there is insignificant risk of peat landslide. However, it may be prudent to microsite the track alignment and turbine position slightly to the north to take advantage of the shallower slopes in this part of the location. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	2	Low Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Kf

Grid Reference	HU 3920 5780	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 29	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.0	Primary receptor (stream order)	Unnamed tributary to Burn of Lunklet (1) / Burn of Weisdale (1)
Width (m)	300		
Down slide distance (m)	90	Secondary receptor (stream order)	Burn of Lunklet (3) / Burn of Weisdale (3)
Up slide distance (m)	260		
Volume (m³)	210,000		

Comment / Description
Location <b>Kf</b> is situated on a distinct col between two prominent hills. This area was visited as part of the reconnaissance survey and is documented as Area K2 in the Reconnaissance Survey section of this report. Slopes lie mainly within the range of 6 to 10°, with the steeper slopes coinciding with the areas of rock outcrop. Borrow Pit KBP02 is adjacent to this location and the area includes a significant but variable proportion of bedrock outcrop as slabs and rocksteps. Peat depths are very variable over short distances, with measured values varying between 0.1 and >4m. Areas of deeper peat do not coincide with areas identified as having steep slopes. A small collapsed peat pipe was observed towards the southern part of the location.

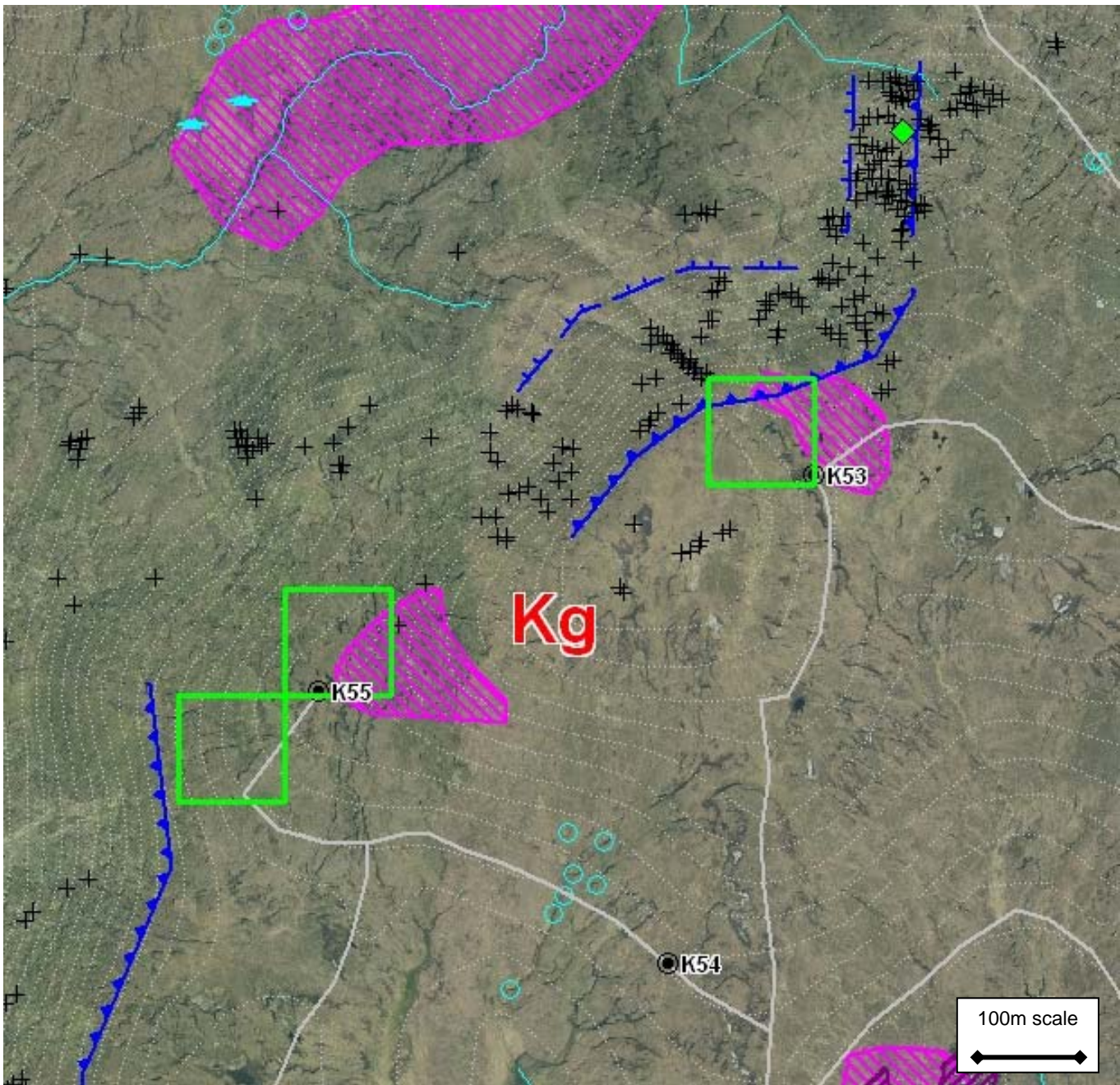
Mitigation
Floating track is recommended for identified areas of deeper peat, especially around Turbine K51. Particular attention will be required in the design of the track to avoid disruption of subsurface flow within the peat. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Kg

Grid Reference	HU 3880 5720	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 28	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.8	Primary receptor (stream order)	Loch of Lunklet / Unnamed tributary to Burn of Lunklet (1)
Width (m)	160		
Down slide distance (m)	620	Secondary receptor (stream order)	Burn of Lunklet (3)
Up slide distance (m)	100		
Volume (m³)	207,400		

Comment / Description
Location <b>Kg</b> includes slopes on the northern side of Scalla Field. Part of the location crosses a convex break in slope, with slope angles mainly <12° above this and >15° below. Whilst there are steep slopes recorded within all grid cells in the location, these lie on the steep hill flanks where peat depths are shallow with mixed rock outcrop in places. Areas of deep peat are also recorded but these are not coincident with either the steep slopes or the proposed infrastructure. Peat within the northern part of the location has been subject to extensive erosion to mineral soil, particularly apparent in the col near Turbine K53.

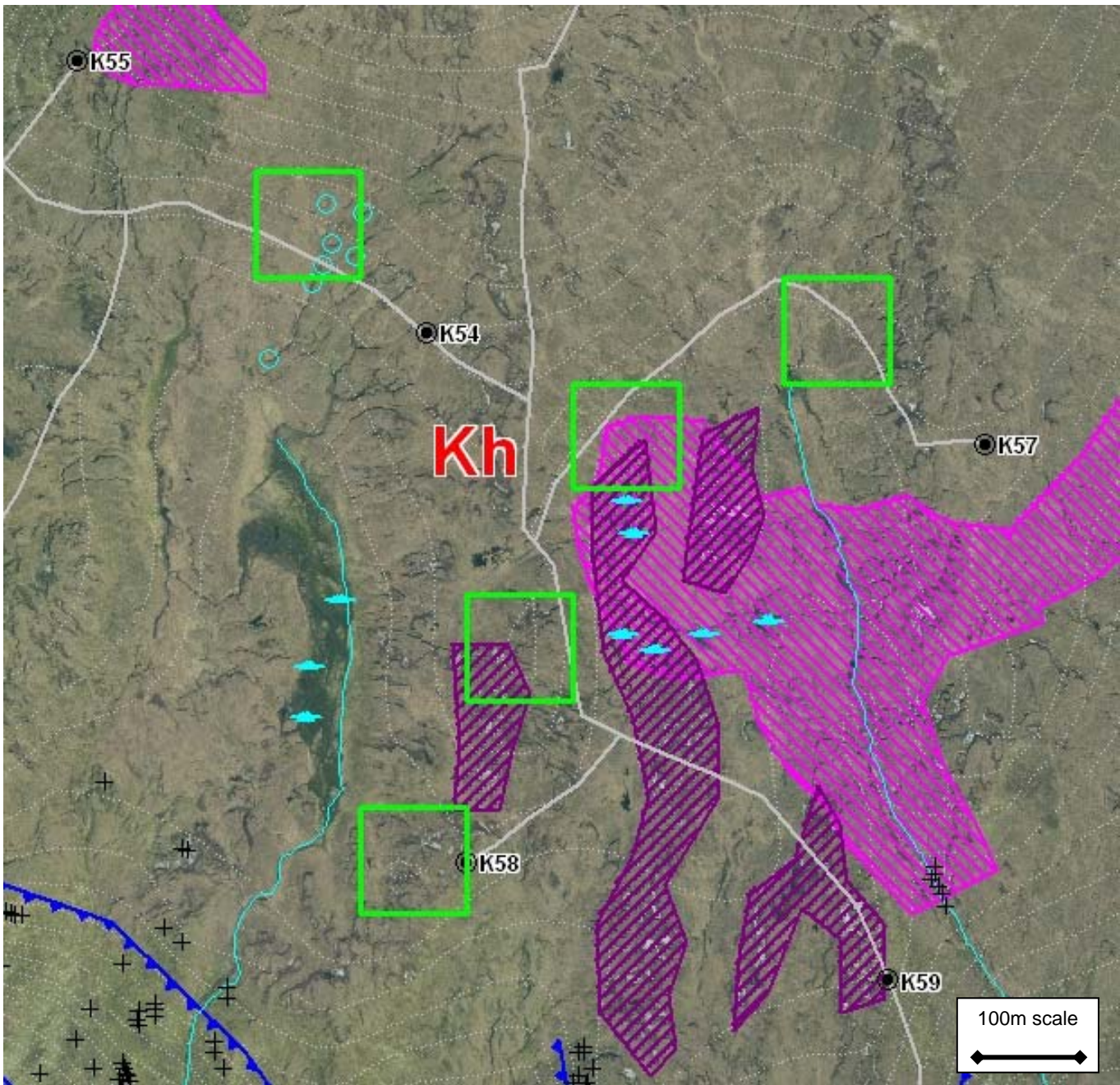
Mitigation
Whilst the risk of peat landslide has been assessed as insignificant, it may be prudent to microsite Turbines K53 and K55 slightly to the south to areas of shallower peat and flatter slopes. Care should be taken to ensure appropriate drainage is installed to minimise disruption to the natural peat drainage channels and gullies. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Kh

Grid Reference	HU 3915 5675	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 19	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.6	Primary receptor (stream order)	Unnamed tributary to Lamba Water (1) / Unnamed tributary to Burn of Weisdale (1)
Width (m)	140		
Down slide distance (m)	250	Secondary receptor (stream order)	Lamba Water / B9075
Up slide distance (m)	280		
Volume (m³)	118,700		

Comment / Description
Location <b>Kh</b> is situated in and around an area of marshy ground. The marshy areas are characterised by nearly flat slopes and deep peat dissected by deep drainage channels and small bodies of standing water. Measured peat depths vary from >4m in the marshy areas to 0 in areas of eroded peat. Slopes up to 12° or more were recorded around the margins of the location. Preliminary assessment highlighted this location as potentially at risk of peat landside owing to the occurrence of deep peat and steep slopes within the same grid cell. Closer inspection revealed that these were not coincident. Large collapsed peat pipes were observed in the north-western part of the location; additional pipes may be present in this area but not visible at the present time. No signs of current instability were observed.

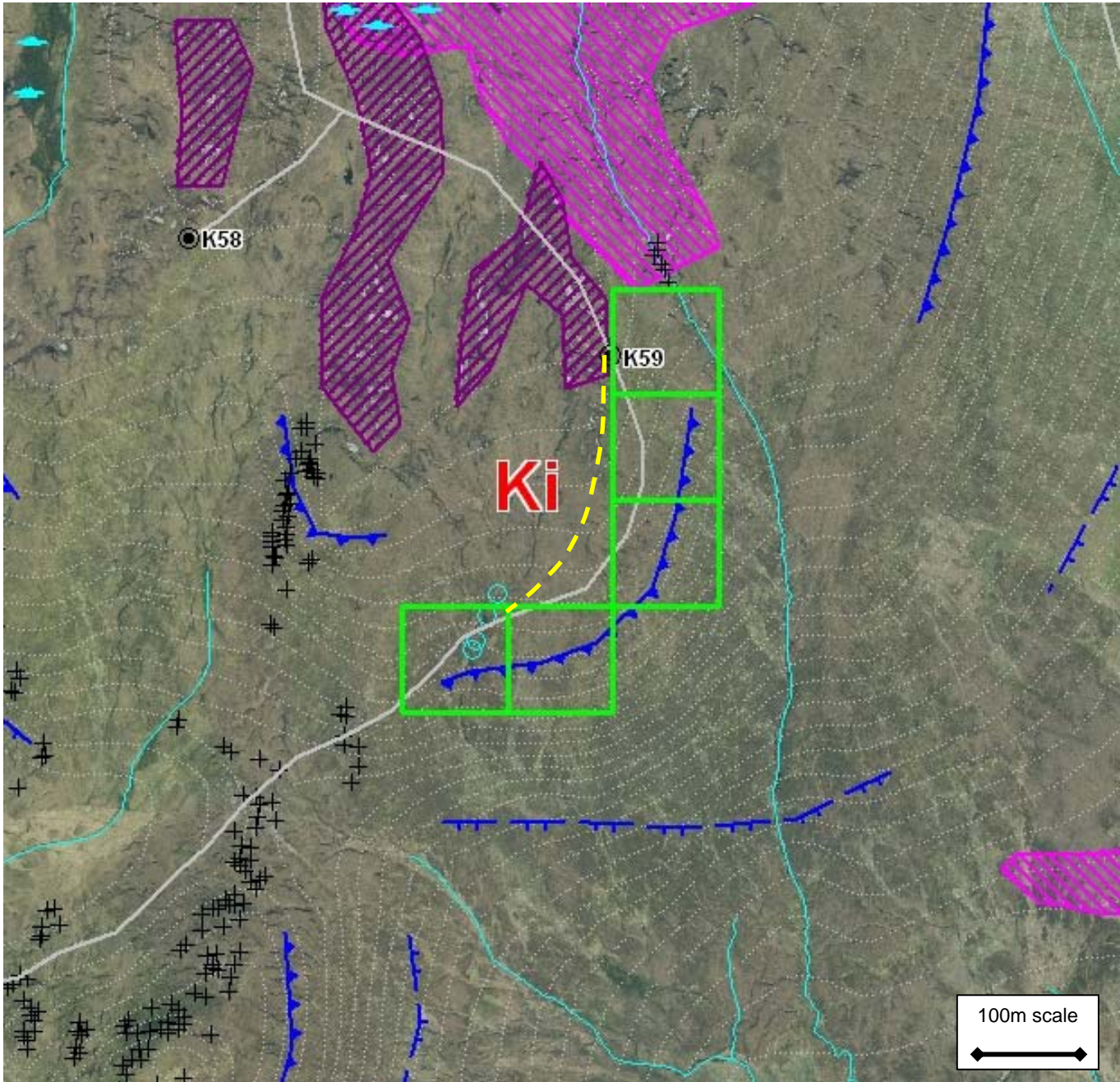
Mitigation
As the risk of peat landslide is insignificant there is therefore no requirement for mitigation. Care should be taken in the north-western part of the location because of the presence of collapsed peat pipes; this issue would best be dealt with by micrositeing. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Ki

Grid Reference	HU 3940 5605	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	1 – 28	Depth (m)	-							
Max. Depth (m)	2.8	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.4	Primary receptor (stream order)	Unnamed tributary to Burn of Weisdale (1)
Width (m)	200		
Down slide distance (m)	460	Secondary receptor (stream order)	B9075
Up slide distance (m)	80		
Volume (m³)	151,200		

Comment / Description
Location <b>Ki</b> lies along the side of a hill shortly above a convex break in slope. Slope angles above the break are mostly within the range of 8 to 10° and below are generally >15°. The break in slope is mostly at least 30m distant from the proposed track line. Measured peat depths in the area range from 0.3 to 2.8m with the deeper peat coinciding with the gentler slopes. A large partially collapsed peat pipe was observed in the southern part of the location along the side of a topographic hollow with deep peat. Peat in the area is largely intact with some exposed banks and drainage channels in places. The ground was dry underfoot with good vegetation coverage.

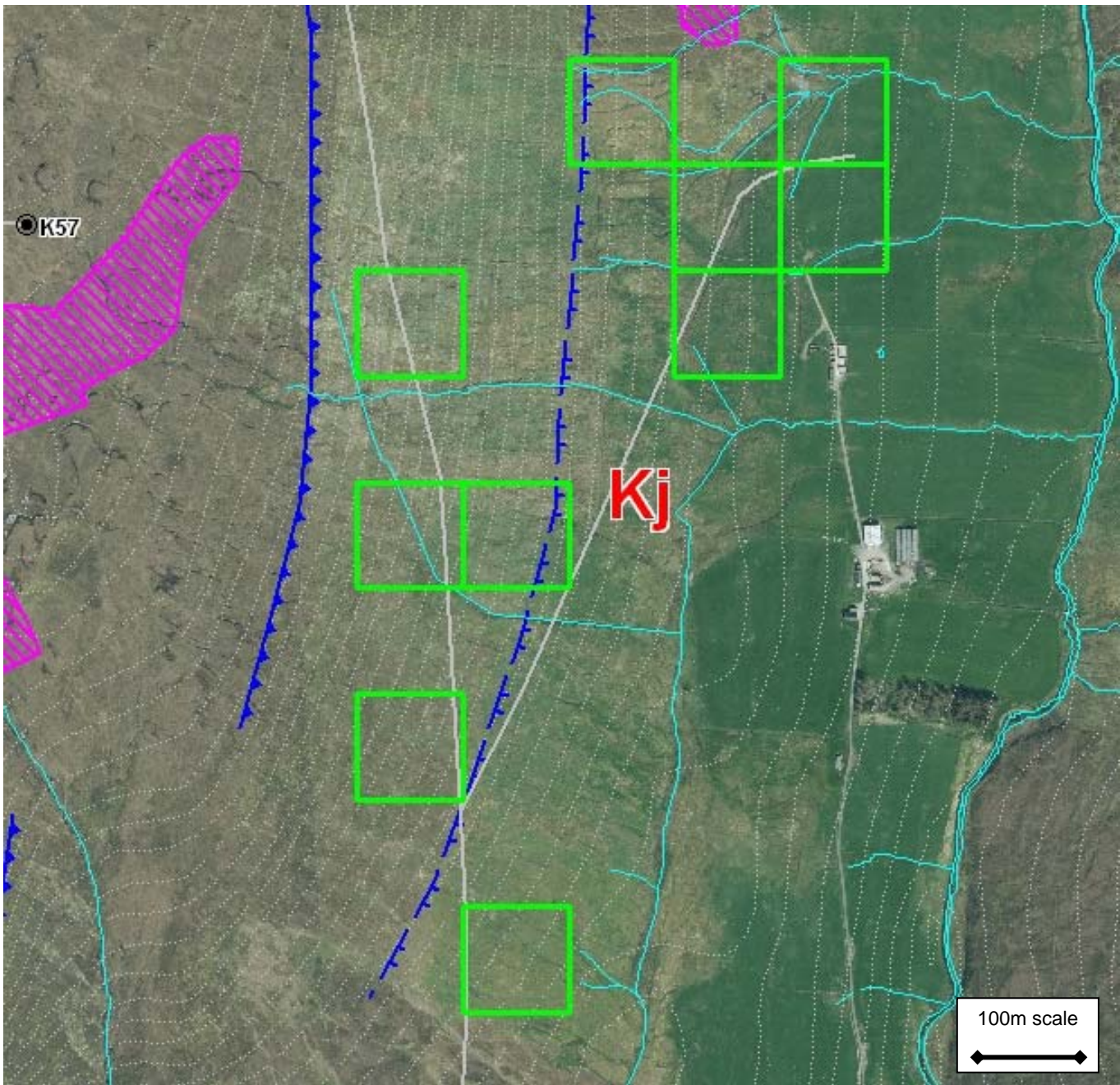
Mitigation
Realignment of the track to the west is recommended to increase the separation from the break in slope and to take advantage of shallower slope angles. Detailed investigation will be required to determine the size and nature of the peat pipe at the southern end and whether there are other peat pipes in the area. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Kj

Grid Reference	HU	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	4 – 22	Depth (m)	0.75	0.5	36.24	45.03	37.37	39.7	49.4	41.0
Max. Depth (m)	1.8	Bulk Density (Mg/m³)	1.04	1.5	>518			>189.3		
Min. FoS	26.5	Von Post classification	H3							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.2	Primary receptor (stream order)	Unnamed tributary to Burn of Weisdale (1)
Width (m)	170		
Down slide distance (m)	360	Secondary receptor (stream order)	Burn of Weisdale (3)
Up slide distance (m)	410		
Volume (m³)	157,100		

**Comment / Description**

Location **Kj** lies along the eastern side of a steep slope, including steeper mid sections and gentler lower slopes. Slope angles range from 4 to 22°. Slopes above about 15° have measured peat depths up to 1m but mostly less; shallow slopes of around 6 to 8° in the valley floor tend to have deeper peat, although fewer measurements are available owing to track realignments. Preliminary assessment highlighted this location as potentially at risk of peat landslide owing to the proximity of Upper Kergord farm to the infrastructure layout, the presence of steep slopes and deep peat. Measured shear strength values are very high. Measurements deeper than 0.5m were not possible because of the extremely high strength of the substrate. Calculated FoS values indicate that the slopes are very stable in this area. Von Post classification of the peat indicates it is only weakly decomposed.

**Mitigation**

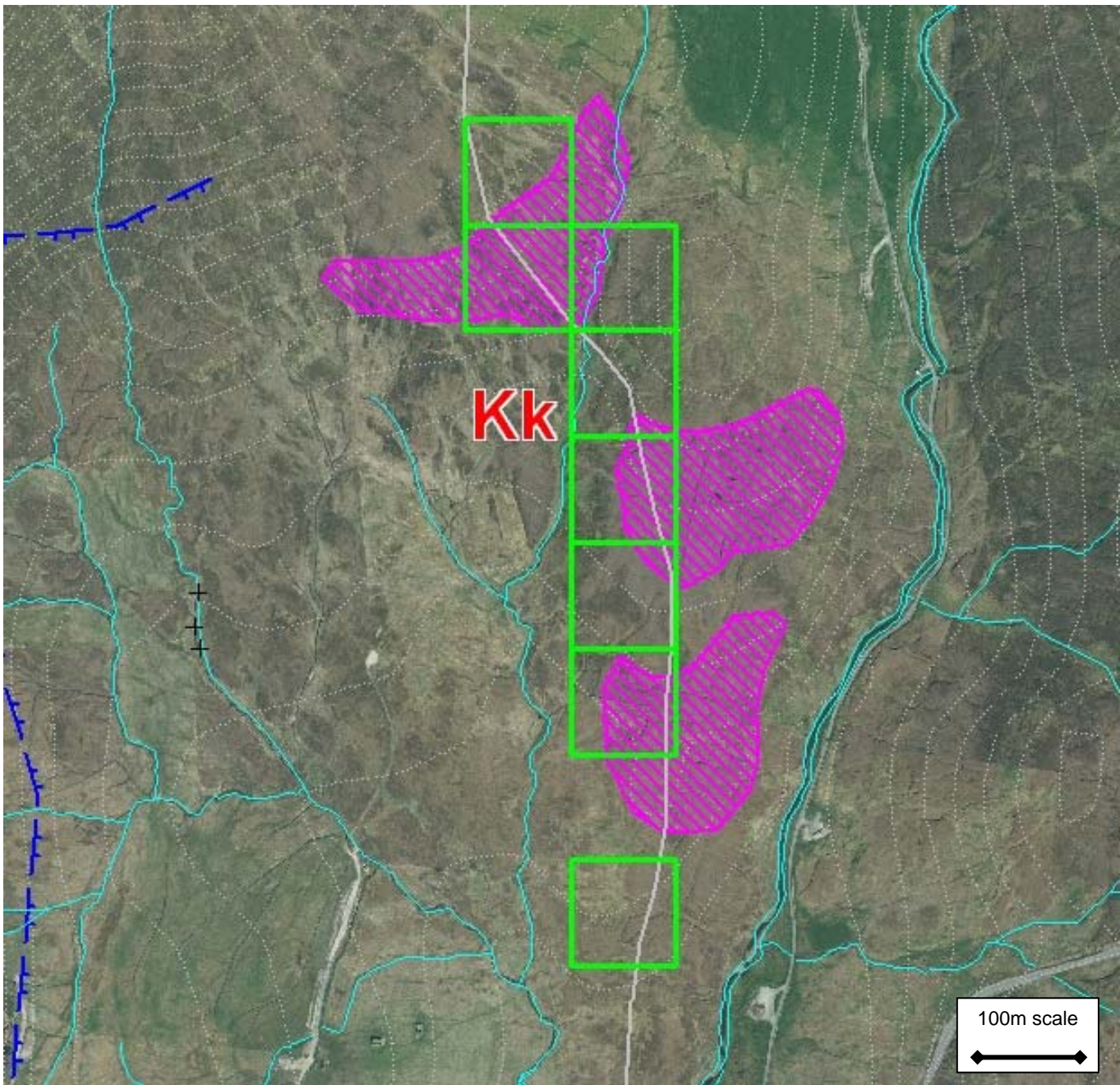
Measured shear strength and calculated FoS values for this location indicate that there is insignificant risk of peat landslide despite the proximity of habitation. Consequently there is no requirement for mitigation. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	4	Very High Impact	8	Significant
Final	1	Negligible	4	Very High Impact	4	Insignificant



LOCATION Kk

Grid Reference	HU 4007 5555	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 20	Depth (m)	-							
Max. Depth (m)	3.8	Bulk Density (Mg/m <sup>3</sup> )	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.4	Primary receptor (stream order)	Unnamed tributary to Burn of Weisdale (2)
Width (m)	400		
Down slide distance (m)	180	Secondary receptor (stream order)	B9075
Up slide distance (m)	100		
Volume (m³)	268,800		

Comment / Description
Location <b>Kk</b> is situated on either side of a stream valley. The upper part of the stream channel is quite incised with steep slopes immediately beside the stream. In other parts of the location slopes are generally less than 10°. Measured peat depths through the location range from 0 to 3.8m and change quickly over short distances. Areas of deep peat have been highlighted during peat depth surveys. Preliminary assessment highlighted this location as potentially being at risk of peat landslide owing to the presence of steep slopes and deep peat within the same grid cell. Closer inspection revealed that they are not coincident and the steep sections of slope are confined to the stream valley, except at the very northern end of the location where the slope begins to steepen.

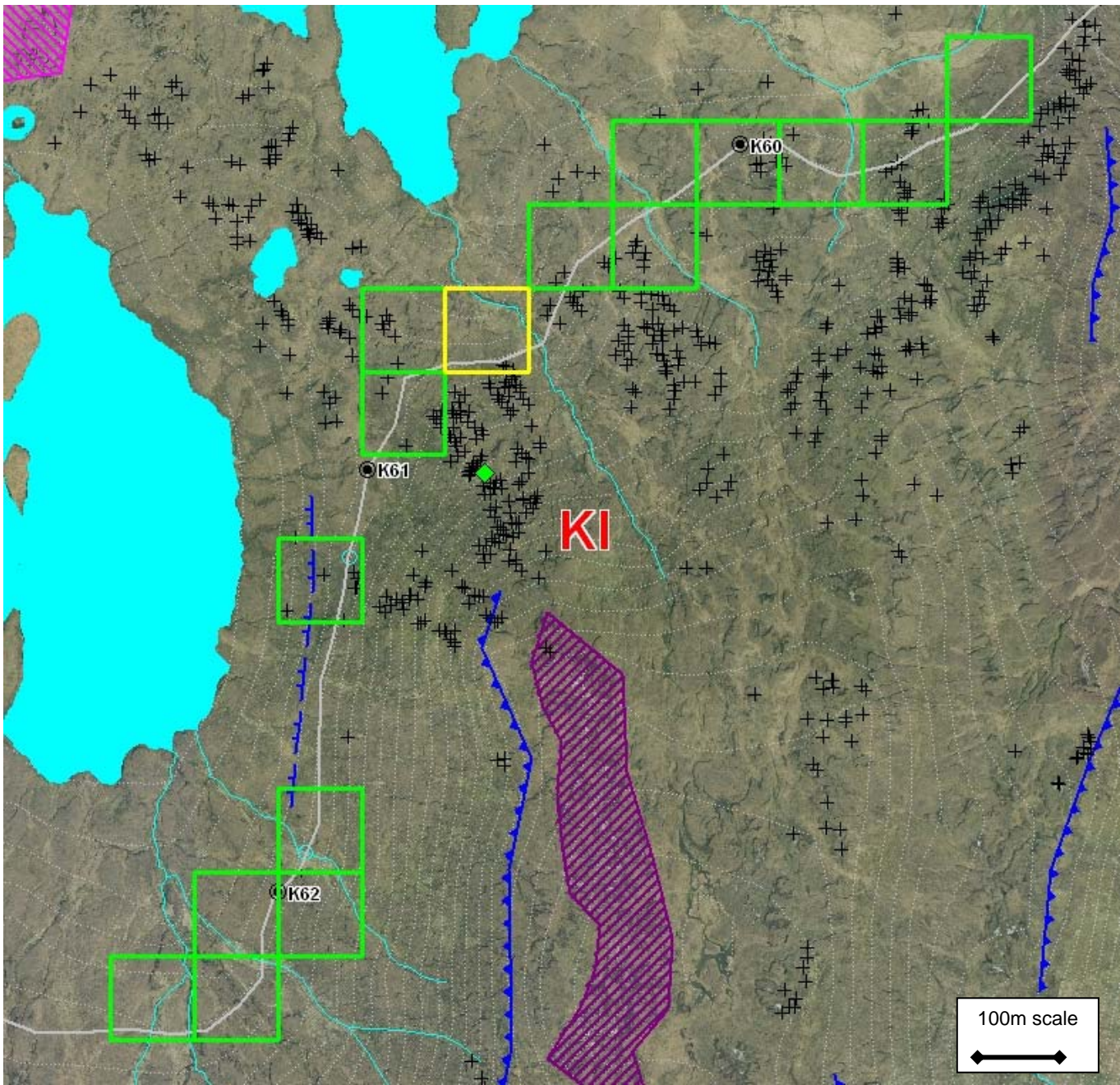
Mitigation
Floating track construction is recommended for the areas of deeper peat. Attention will be required in the track design to avoid disruption of subsurface flow within the peat. Micrositing may be necessary around the watercourse crossing to avoid the steep slope sections. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION KI

Grid Reference	HU 3830 5540	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 25	Depth (m)	0.85	0.4	17.65	15.07	18.84	24.0	20.5	25.6
Max. Depth (m)	3.5	Bulk Density (Mg/m³)	1.00	0.8	36.09	17.25	32.12	24.5	11.7	21.8
Min. FoS	11.7	Von Post classification	H4							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.6	Primary receptor (stream order)	Unnamed tributaries to Lamba Water / Maa Water (1,2)
Width (m)	530		
Down slide distance (m)	300	Secondary receptor (stream order)	Lamba Water / Maa Water
Up slide distance (m)	490		
Volume (m³)	669,900		

**Comment / Description**

Location KI follows the slopes around above Lamba and Maa Waters. This area was visited as part of the reconnaissance survey and is documented as Area K3 in the Reconnaissance Survey section of this report. Slope angles are variable as the location follows the slopes above the loch shores. Most proposed infrastructure is on slopes of <12°. Measured peat depths are also variable, from 0.2 to 3.5m and often change quickly over short distances indicating that the peat forms isolated pockets. Measured shear strength values are high, giving very stable FoS values for this area. The von Post classification indicates that the peat is weakly decomposed. There is a substantial amount of bedrock exposure along the slopes in this location, supporting the indication that peat forms mainly in pockets. A small collapsed peat pipe was observed above Maa Water, indicating a slightly larger pocket of peat in this section.

**Mitigation**

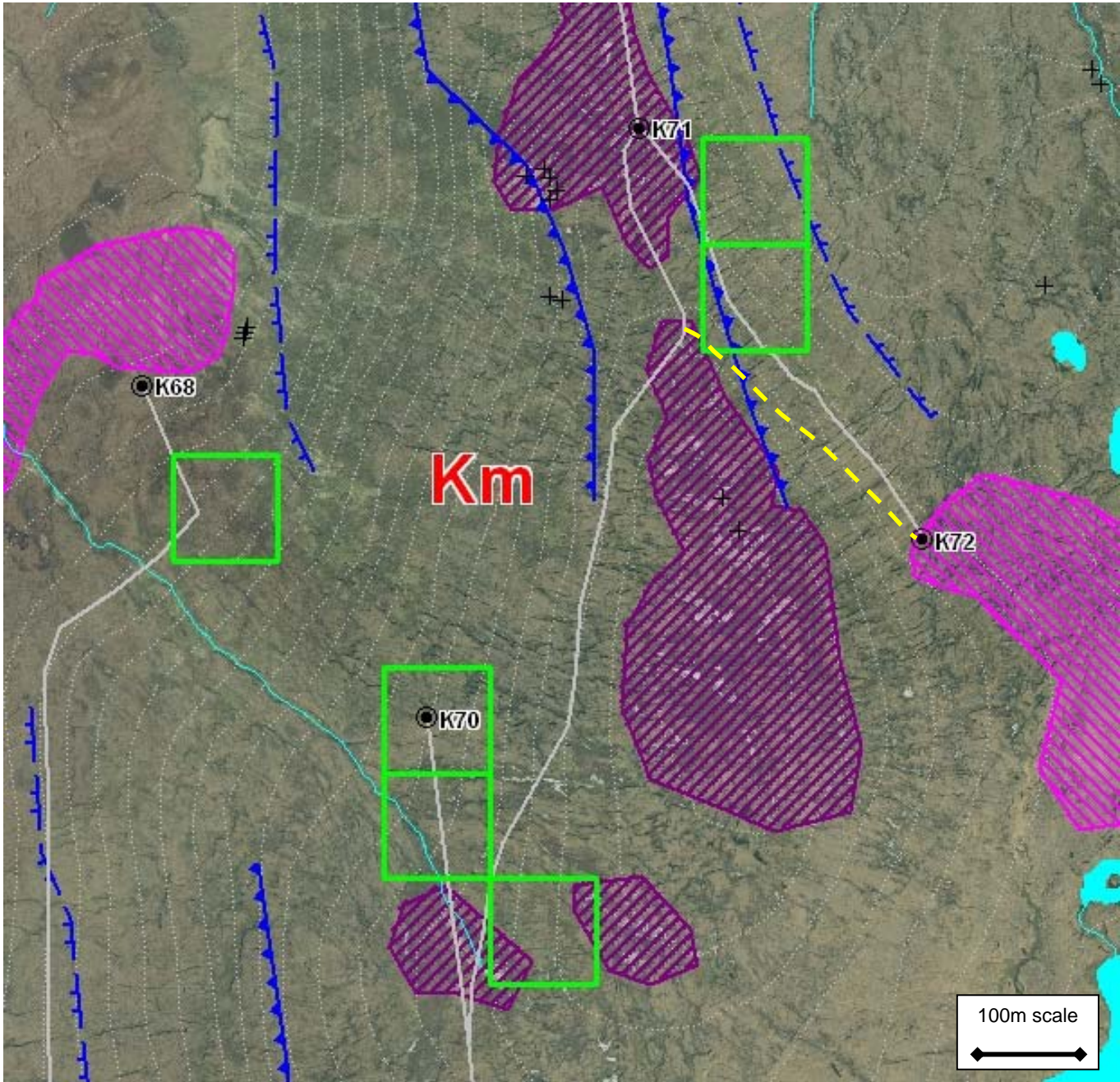
The high FoS values and prevalence of bedrock exposure across this location indicate that risk of instability is insignificant. Detailed investigation is recommended to assess the possibility that further peat pipes exist in the area. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	3	High Impact	12	Substantial
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Km

Grid Reference	HU 3730 5600	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 25	Depth (m)	-							
Max. Depth (m)	2.2	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.4	Primary receptor (stream order)	Unnamed tributaries to South Burn of Burrafirth (1) / Burn of Lambawater (1)
Width (m)	180		
Down slide distance (m)	450	Secondary receptor (stream order)	South Burn of Burrafirth (3) / Burn of Lambawater (2)
Up slide distance (m)	190		
Volume (m³)	161,300		

**Comment / Description**

Location Km lies along the side of a wide hill. The northern part of the location falls on a steep section of slope between the upper convex and lower concave breaks in slope, with the proposed track line crossing the convex break in slope. Slopes angles across much of the location are less than 10° although below convex breaks in slope are often 12° or more. Peat depths are variable as the area has been subject to substantial erosion. Measured depths range between 0.2 and 2.2m, with no very deep peat recorded in the location. In some areas peat has been eroded to mineral soil.

**Mitigation**

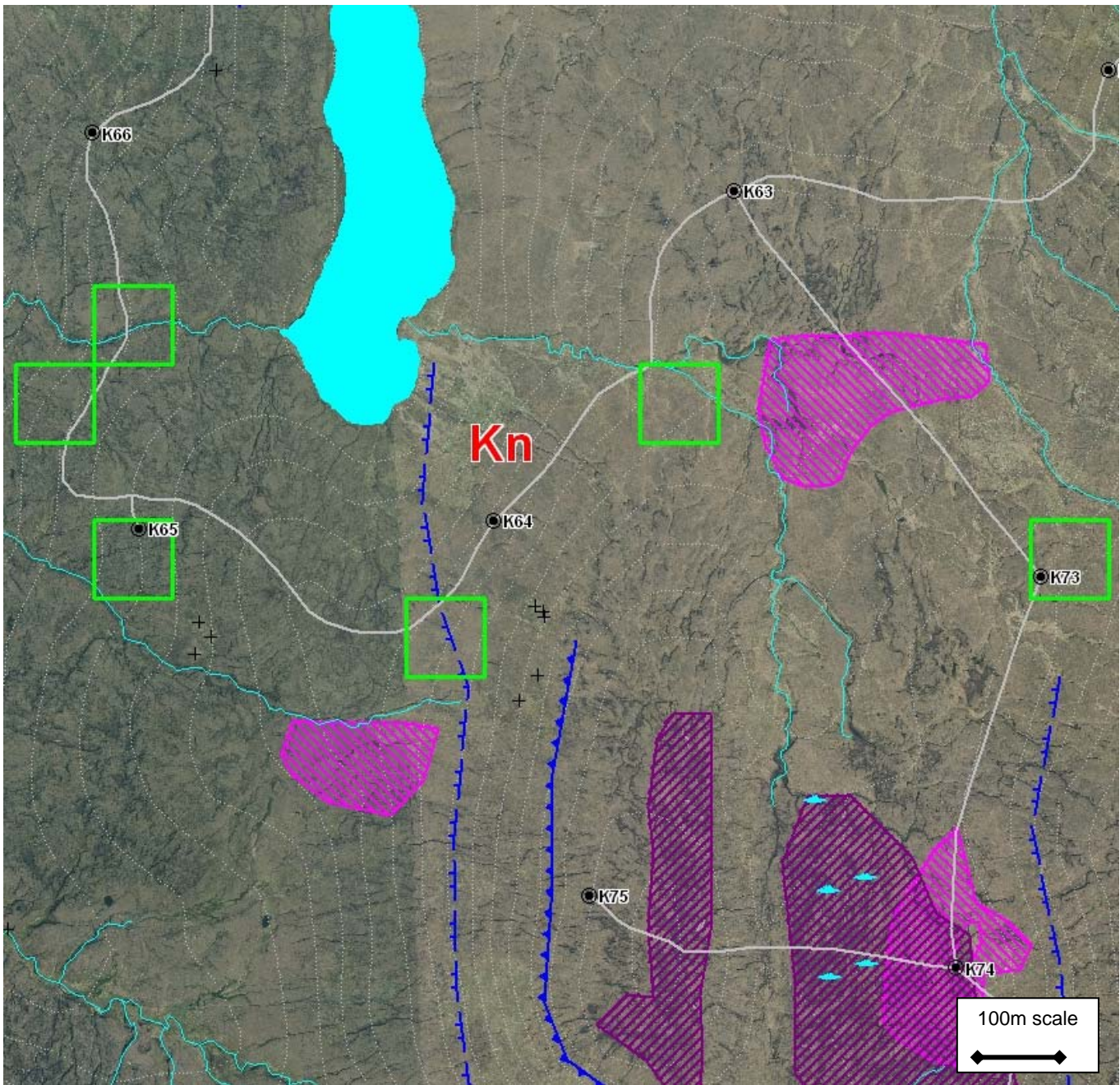
Micrositing of the northern track section to the west is recommended, to areas with shallower slope angles and to minimise the section close to the convex break in slope. Care will be required during construction of this section owing to the increased risk of construction on convex slopes. Micrositing may be required in other parts of the area, especially around the watercourse crossings in the southern part of the site, to avoid steeper slopes in the stream channel. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Kn

Grid Reference	HU 3750 5440	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 15	Depth (m)	-							
Max. Depth (m)	2.4	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.9	Primary receptor (stream order)	Unnamed tributaries to Truggles Water (2) / Truggles Water
Width (m)	100		
Down slide distance (m)	390	Secondary receptor (stream order)	Truggles Water / South Burn of Burrafirth (3)
Up slide distance (m)	260		
Volume (m³)	123,500		

Comment / Description
Location <b>Kn</b> lies around the southern side of Truggles Water on a series of moderate slopes. Slope angles in this location are generally less than 8°. Measured peat depths range from 1.4 to 2.4m. Preliminary assessment highlighted this location as potentially at risk of peat instability through the presence of deep peat and moderately steep slopes within the same grid cell. Detailed inspection of the affected cells indicates that the deep peat is present in a different part of the cell from the steep slopes and consequently the risk of instability is much less than initially implied.

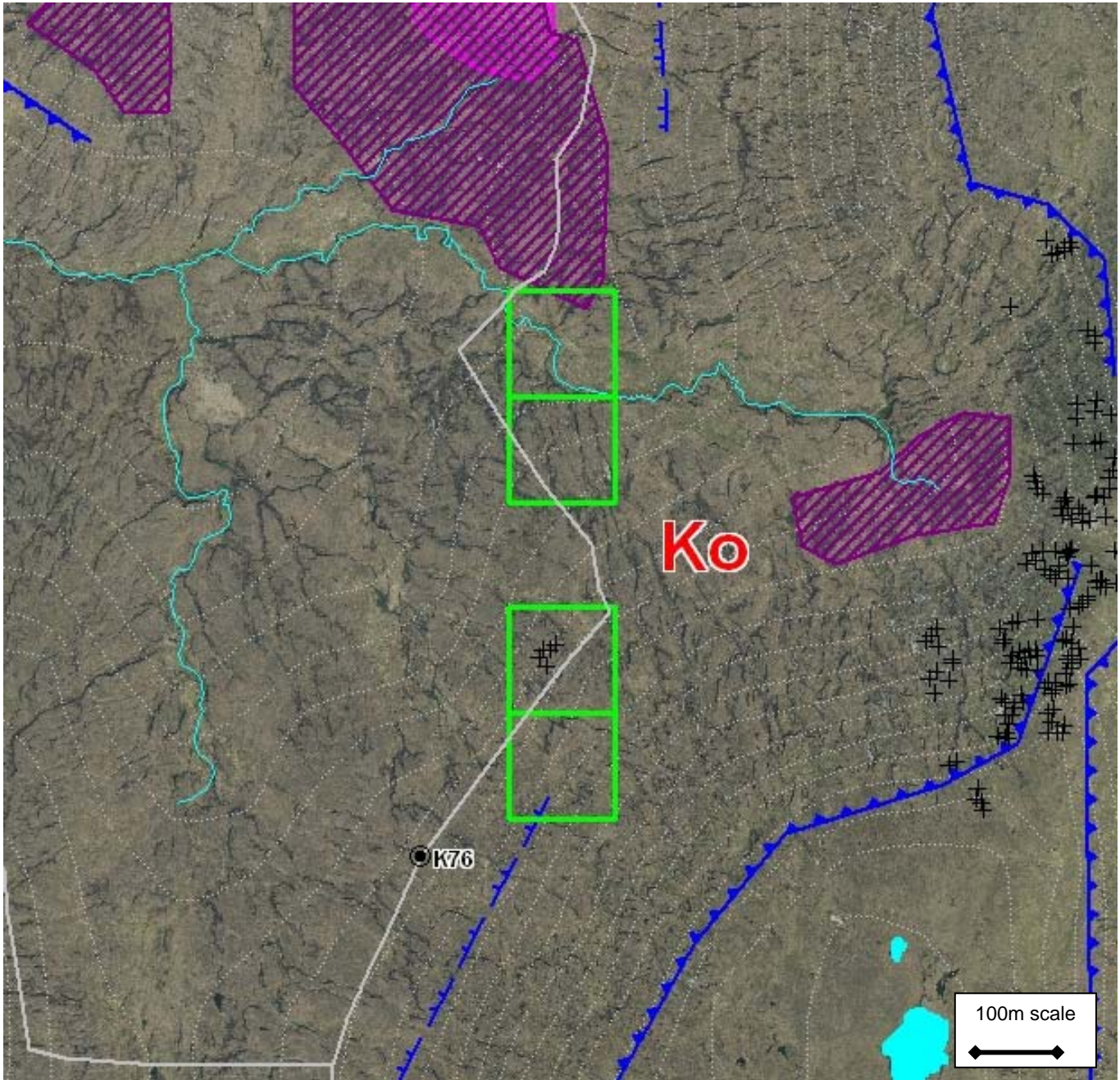
Mitigation
Floating track construction may be necessary for some areas of deeper peat. Attention will be required in the track design to avoid disruption to subsurface flow within the peat in these areas. Micrositing of track lines and turbine positions may help to increase the separation from higher risk areas. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Ko

Grid Reference	HU 3799 5300	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 17	Depth (m)	-							
Max. Depth (m)	3.8	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.1	Primary receptor (stream order)	Unnamed tributaries to Burn of Atlascord (1)
Width (m)	160		
Down slide distance (m)	340	Secondary receptor (stream order)	Burn of Atlascord (2)
Up slide distance (m)	280		
Volume (m³)	208,300		

Comment / Description
Location <b>Ko</b> lies on the lower slopes of a long hillside near the headwaters of a stream. Measured peat depths in the area are quite variable, ranging between 0.7 and 3.8m. Peat shows variable degrees of erosion with some areas being highly dissected by drainage channels and others being nearly intact. Peat depths show a high level of variability over short distances. Slope angles are mostly fairly moderate with some strong local variability around the indicated area of bedrock exposure. The DEM has not resolved the detailed topography very well in this area as the bedrock is situated on the end of a small spur and local slope angles are high. Although both deep peat and steep slopes have been identified within this location, detailed inspection indicates that they are not coincident.

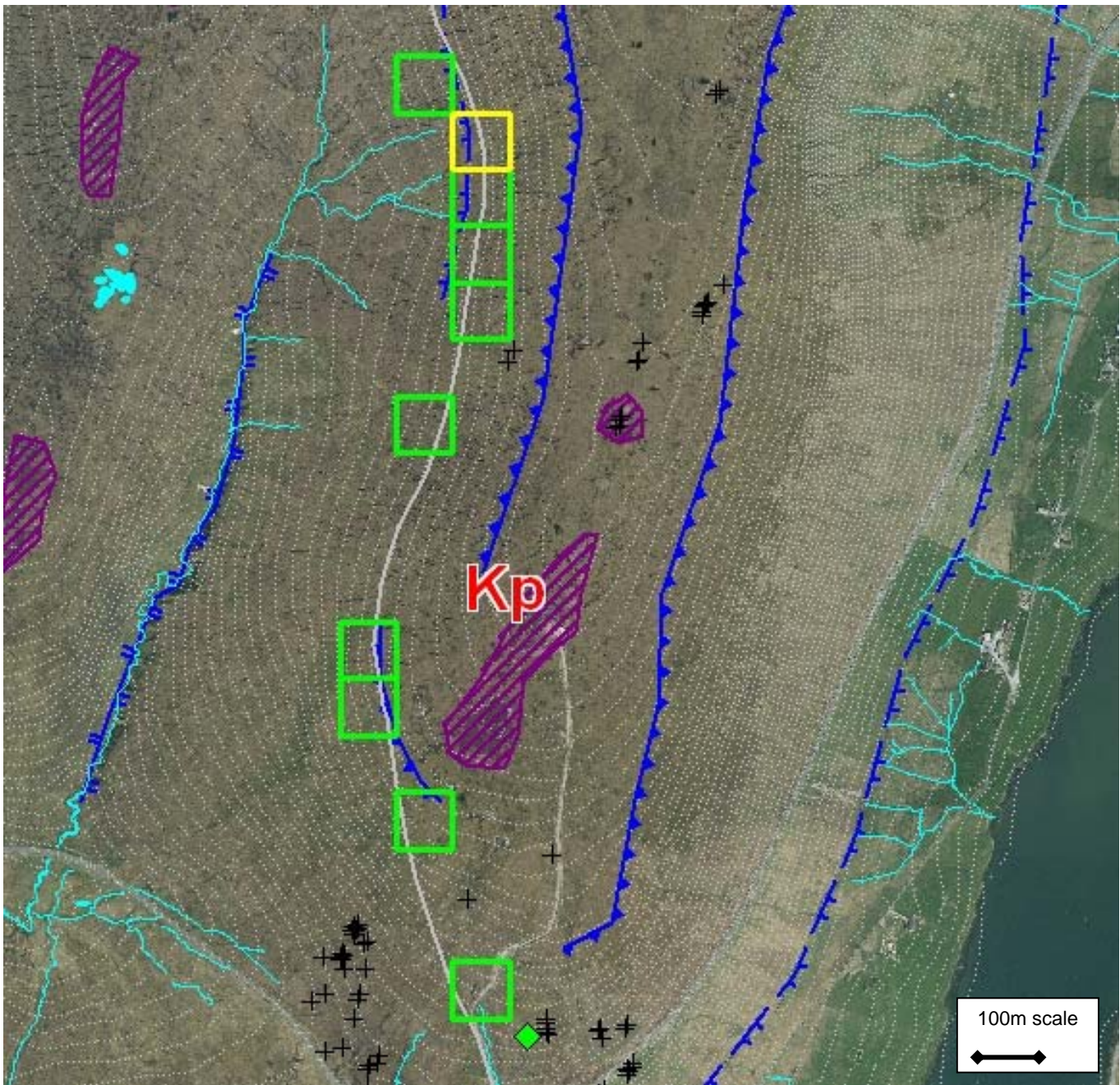
Mitigation
On the basis of the above observations from the area it is considered that the risk of peat landslide in this location is insignificant. Care will be required during detailed design to ensure that drainage from the peat channels is not disrupted. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Kp

Grid Reference	HU 3777 5160	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	4 – 22	Depth (m)	1.55	0.5	21.36	21.43	29.44	22.3	22.4	30.7
Max. Depth (m)	2.5	Bulk Density (Mg/m³)	0.99	1.5	21.76	18.01	-	7.6	6.3	-
Min. FoS	6.3	Von Post classification	H4	2.2	51.95	37.01	-	12.3	8.8	-



Estimated Peat Slide Parameters

Estimated average peat depth (m)	1.4	Primary receptor (stream order)	Unnamed tributaries to Burn of Tactigill (1) / Weisdale Voe
Width (m)	410		
Down slide distance (m)	210	Secondary receptor (stream order)	Burn of Tactigill (2) / A971
Up slide distance (m)	180		
Volume (m³)	223,900		

Comment / Description

Location **Kp** is situated on the western side of a long hill, above a deeply incised river valley. The proposed track line runs approximately parallel to the contours along the hillside. Measured peat depths through the location range from 0.6 to 2.5m with the deeper peat forming on the gentler slopes at the northern end of the site. Slope angles are quite variable, Along the proposed infrastructure lines they fall mainly between 8 and 12°. Measured shear strengths from the site are high, giving fully stable FoS values. Bulk density is moderate, possibly indicating a high water content. The von Post classification indicates the peat is weakly decomposed.

Mitigation

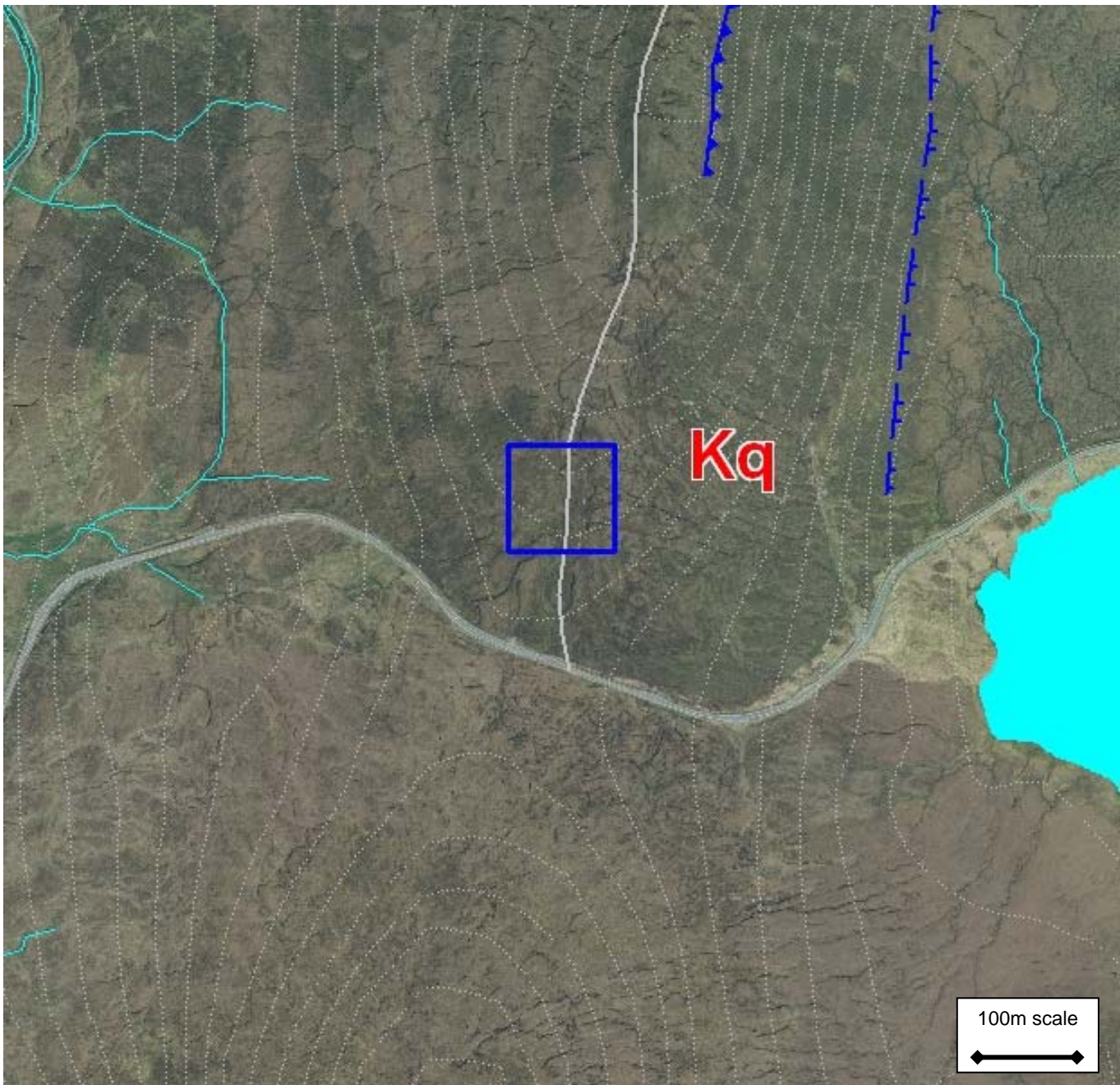
The high FoS values calculated for the location indicate that the risk of peat landslide is insignificant and consequently no mitigation is required. However, owing to the steep slopes within the area extra care should be taken during construction to ensure slope stability, particularly towards the southern part of the location where a small convex break in slope has been identified. Micrositing may be required in this area to overcome construction difficulties associated with steep slope angles. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	3	High Impact	12	Substantial
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Kq (control)

Grid Reference	HU 4086 5515	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 10	Depth (m)	1.5	0.5	14.46	14.13	14.08	24.0	23.5	23.4
Max. Depth (m)	1.5	Bulk Density (Mg/m³)	1.12	1.0	12.52	14.20	12.42	10.4	11.8	10.4
Min. FoS	10.4	Von Post classification	H5							



Estimated Peat Slide Parameters

Estimated average peat depth (m)		Primary receptor (stream order)	
Width (m)			
Down slide distance (m)		Secondary receptor (stream order)	
Up slide distance (m)			
Volume (m³)			

Comment / Description

Location **Kq** is on the southernmost slopes of Mid Kame ridge. Slope angles are fairly gentle in this area, up to 10° with the steepest slopes towards the western side of the cell. Measured peat depths are mostly shallow, ranging between 0.4 and 1.5m. Peat in the area has been eroded to some degree, with some peat banks and gullying although no mineral soil is exposed. Shear strengths measured at this location are reasonably high, giving fully stable FoS values. The peat has a high bulk density and the von Post classification indicates it is moderately to strongly decomposed in the lower section.

Mitigation

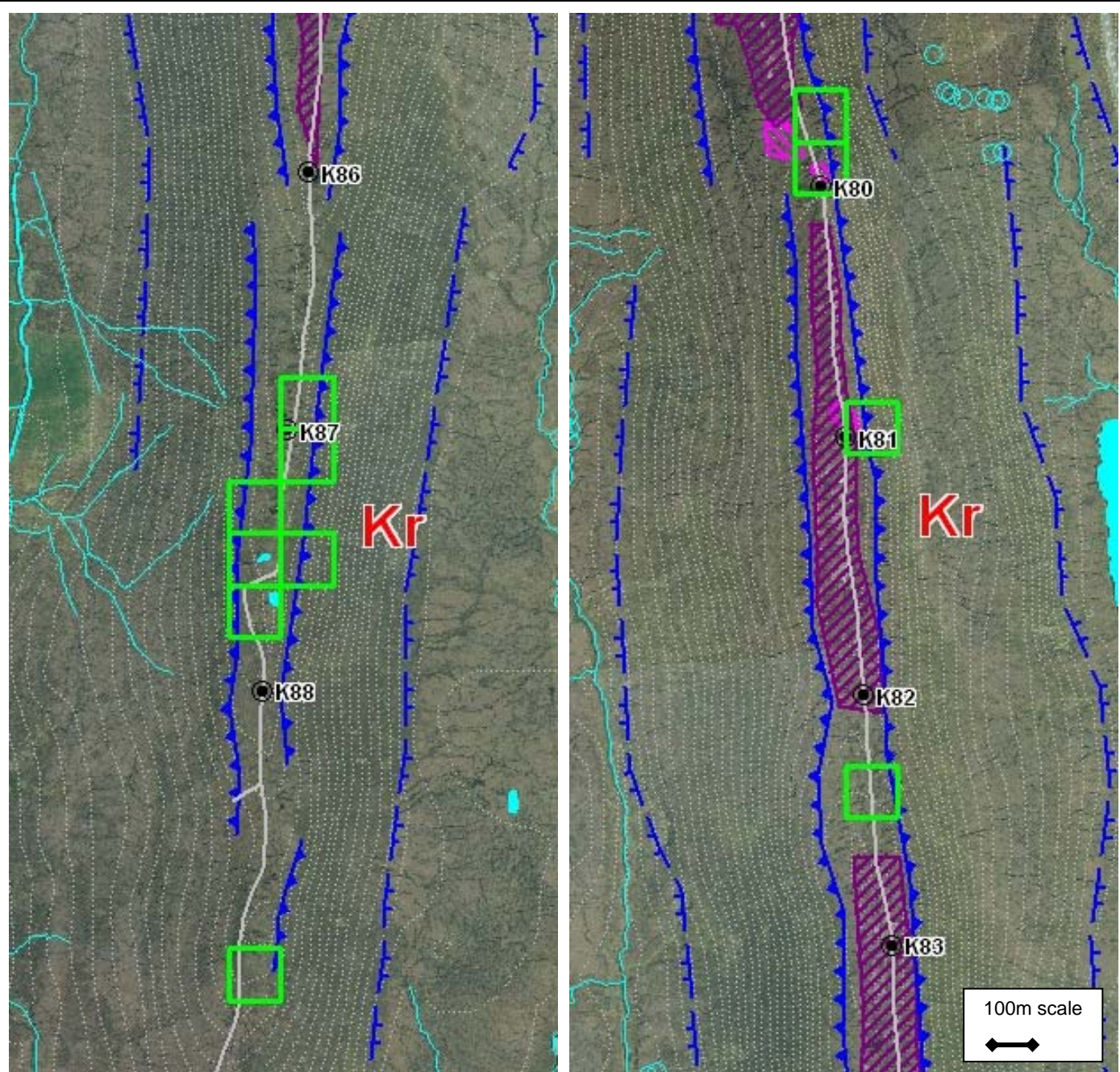
As the risk of peat landslide is insignificant there is no requirement for mitigation at this site. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	1	Negligible	2	Low Impact	2	Insignificant
Final	1	Negligible	2	Low Impact	2	Insignificant



LOCATION Kr

Grid Reference	HU 4100 5850	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 35	Depth (m)	-							
Max. Depth (m)	3.2	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.6	Primary receptor (stream order)	Burn of Weisdale (3) / Burn of Pettawater (3)
Width (m)	540		
Down slide distance (m)	480	Secondary receptor (stream order)	Minor road / B9075
Up slide distance (m)	10		
Volume (m³)	423,400		

**Comment / Description**

Location **Kr** includes a series of cells along Mid Kame ridge. The topographical setting is of a steep-sided ridge with a narrow, flat or nearly flat crest. This crest has been subject to extensive erosion, and large areas have been reduced to mineral soil with isolated peat hags. Other areas remain vegetated with networks of drainage channels or pools of standing water. The margins of the crest are marked by strong convex breaks in slope. Slope angles along the ridge crest range up to 7° and are typically >15° on the ridge sides below the break in slope. Measured peat depths are between 0.7 and 3.2m; some of these will reflect a processed depth to include an adjacent peat bank. The track line has been routed to follow the flat ridge crest for the length of the ridge. All of the grid cells highlighted in the preliminary assessment include deep peat and steep slopes; however, detailed inspection indicates that deep peat occurs along the ridge crest and steep slopes below the break in slope.

**Mitigation**

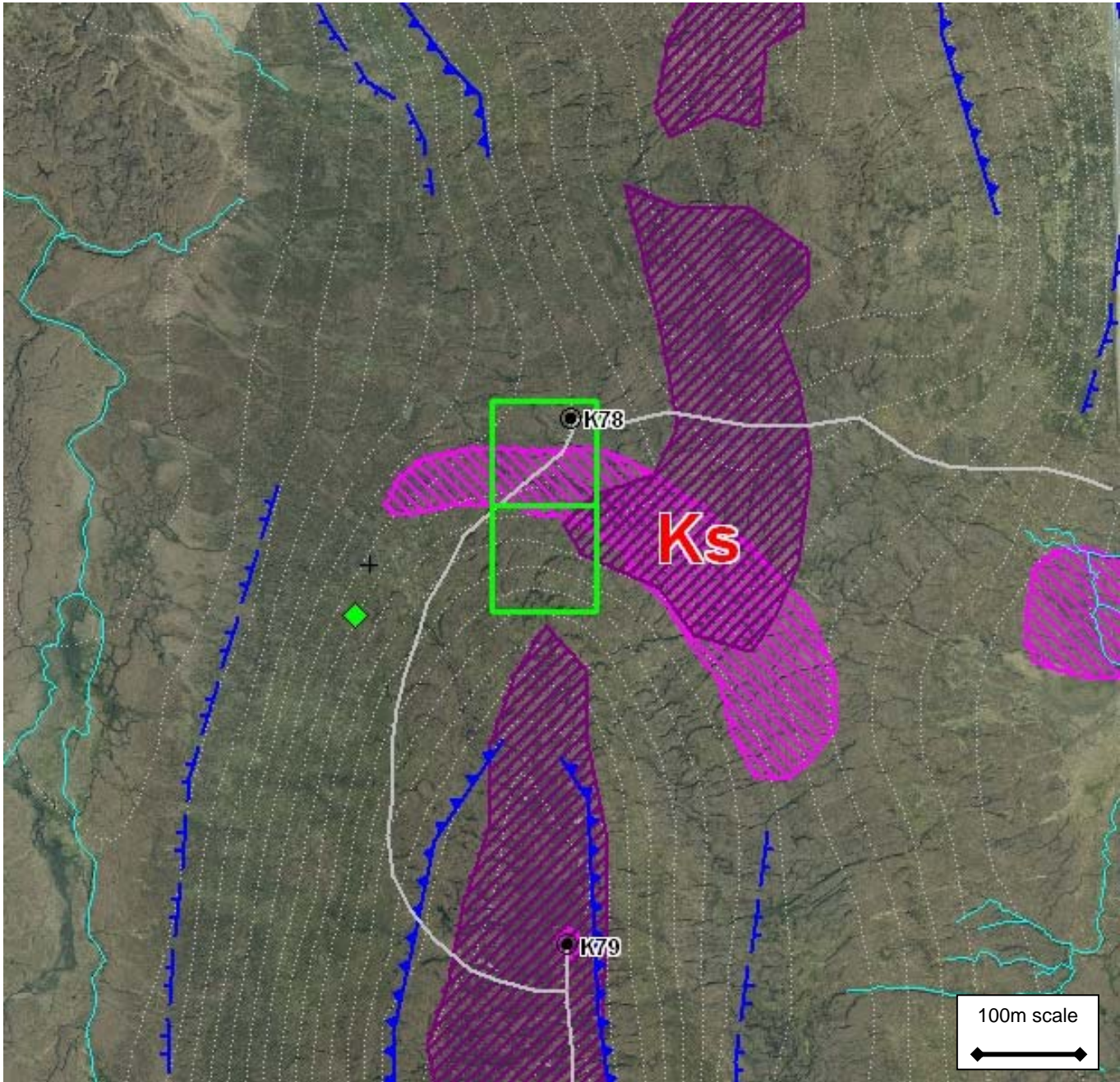
The main risk in this location is posed by the convex breaks in slope along the ridge margins. Care must be taken during track construction to remain as close to the centreline of the ridge as possible, to maximise the distance from the breaks in slope; this is best addressed by micrositeing. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Ks

Grid Reference	HU 4075 6080	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 22	Depth (m)	2.55	0.5	24.56	47.57	24.30	24.7	47.9	24.5
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	1.05	1.5	14.13	14.23	11.74	4.8	4.8	4.0
Min. FoS	4.0	Von Post classification	H6							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.0	Primary receptor (stream order)	Unnamed tributary to Burn of Kirkhouse (1)
Width (m)	140		
Down slide distance (m)	410	Secondary receptor (stream order)	Burn of Kirkhouse (3)
Up slide distance (m)	260		
Volume (m³)	187,600		

Comment / Description
Location <b>Ks</b> is situated at the northern end of Mid Kame ridge, on a narrow col. Slopes in the area are steep in some sections, particularly on the western side of the ridge and on the northern end above the col. These areas are characterised by peat of moderate depth, up to 1m. Deep peat is confined to shallower slopes. Measured shear strength values are high, and FoS values indicate that the slope is stable. The Von Post classification indicates that the lower part of the peat column is strongly decomposed. The track alignment has been routed around the steeper slopes as far as possible and to minimise crossing the area of deep peat identified.

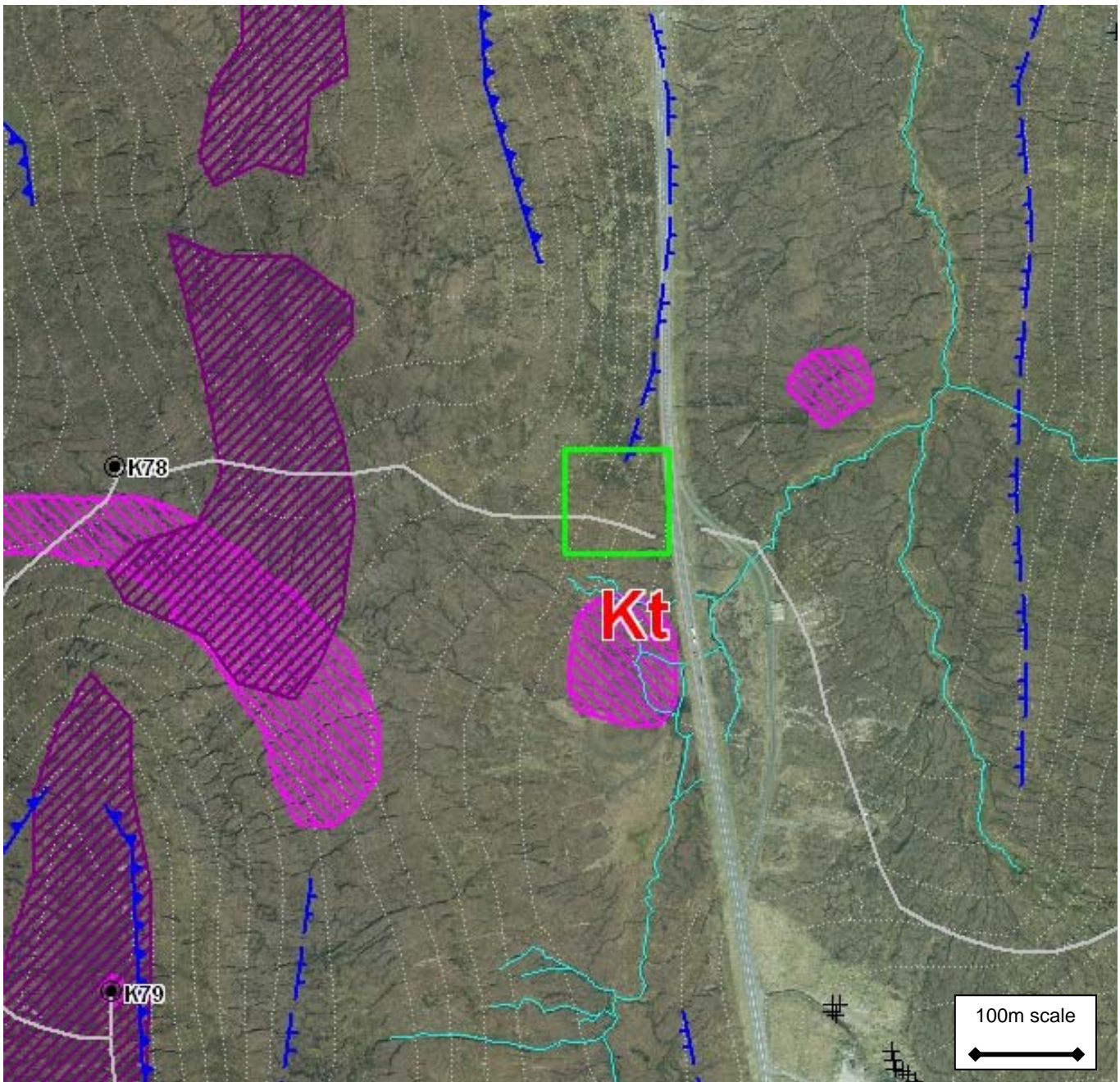
Mitigation
Measured parameters from this site indicate that the slope is stable, giving a hazard ranking of insignificant and indicating that no mitigation is required at this location. The steep slopes in this area may, however, prove problematic in terms of track design parameters. Details of track alignment should be carefully assessed during the detailed design stage to address this problem. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	1	Negligible	2	Low Impact	2	Insignificant



LOCATION Kt

Grid Reference	HU 4125 6085	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	5 – 18	Depth (m)	-							
Max. Depth (m)	1.9	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.7	Primary receptor (stream order)	A970
Width (m)	40		
Down slide distance (m)	100	Secondary receptor (stream order)	Unnamed tributary to Wester Filla Burn (2)
Up slide distance (m)	280		
Volume (m³)	25,800		

**Comment / Description**

Location **Kt** lies at the end of the access route adjacent to the main A970. Slopes across the location vary from 5 to 18° and are steeper in the northern part of the cell. Measured peat depths range from 1.4 to 1.9m; changes in vegetation indicate peat is shallower on the steeper northern slopes and peat depths increase towards the southern part of the cell. Preliminary assessment highlighted this location as potentially at risk of peat landslide through the occurrence of moderately deep peat and steep slopes within a single grid cell. Closer inspection revealed that the steep slopes and deep peat are not coincident. The peat is fairly intact at this location, becoming more dissected in the southern part where stream headwaters have a greater influence.

**Mitigation**

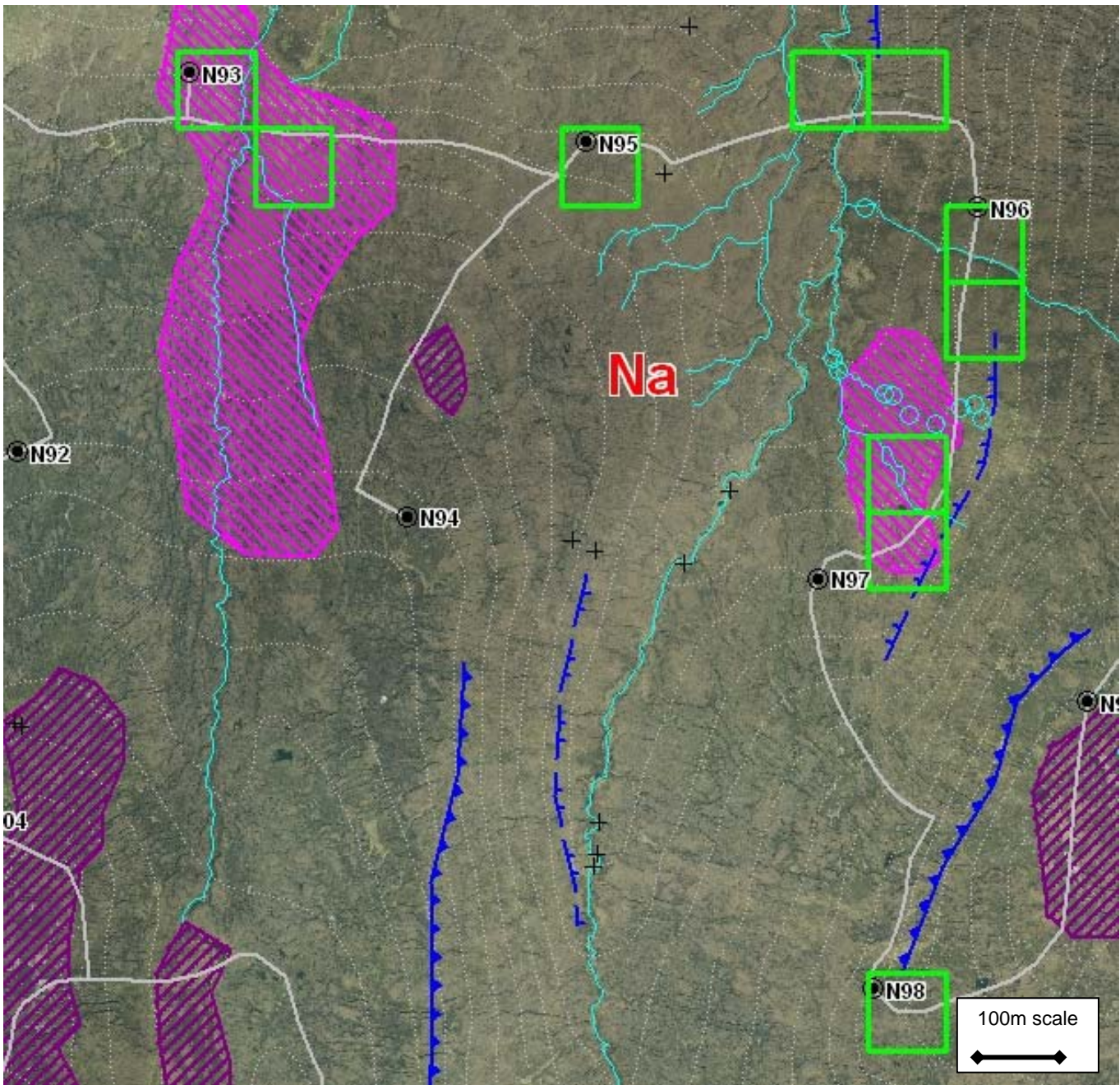
As the risk of peat landslide has been assessed as insignificant, there is no requirement for mitigation at this location. With the close proximity of the main road, care should be taken to minimise disturbance to the peat; floating road construction may be appropriate for the initial section. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Na

Grid Reference	HU 4390 6220	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 13	Depth (m)	-							
Max. Depth (m)	3.6	Bulk Density (Mg/m <sup>3</sup> )	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.7	Primary receptor (stream order)	Thomas Jamieson's Burn (2) / Gossawater Burn (3)
Width (m)	200		
Down slide distance (m)	360	Secondary receptor (stream order)	Laxo Burn (4)
Up slide distance (m)	340		
Volume (m³)	238,000		

Comment / Description
Location <b>Na</b> is situated around two stream valleys. The location has a range of slope angles up to 13° but mostly less than 10°. Both of the watercourses become slightly incised in their lower reaches, giving higher slope angles within the stream channels. Peat depths across the area are variable, ranging between 0.4 and 3.6m. Identified areas of deep peat do not coincide with areas of steeper slope. A partially collapsed peat pipe has been identified in the deep peat area towards the eastern side of the location. The track line in this area runs parallel to and below a concave break in slope, taking advantage of the gentler slope angles whilst also avoiding the deep peat where possible. A convex break in slope further to the south provides some concern for the location of Turbine N98.

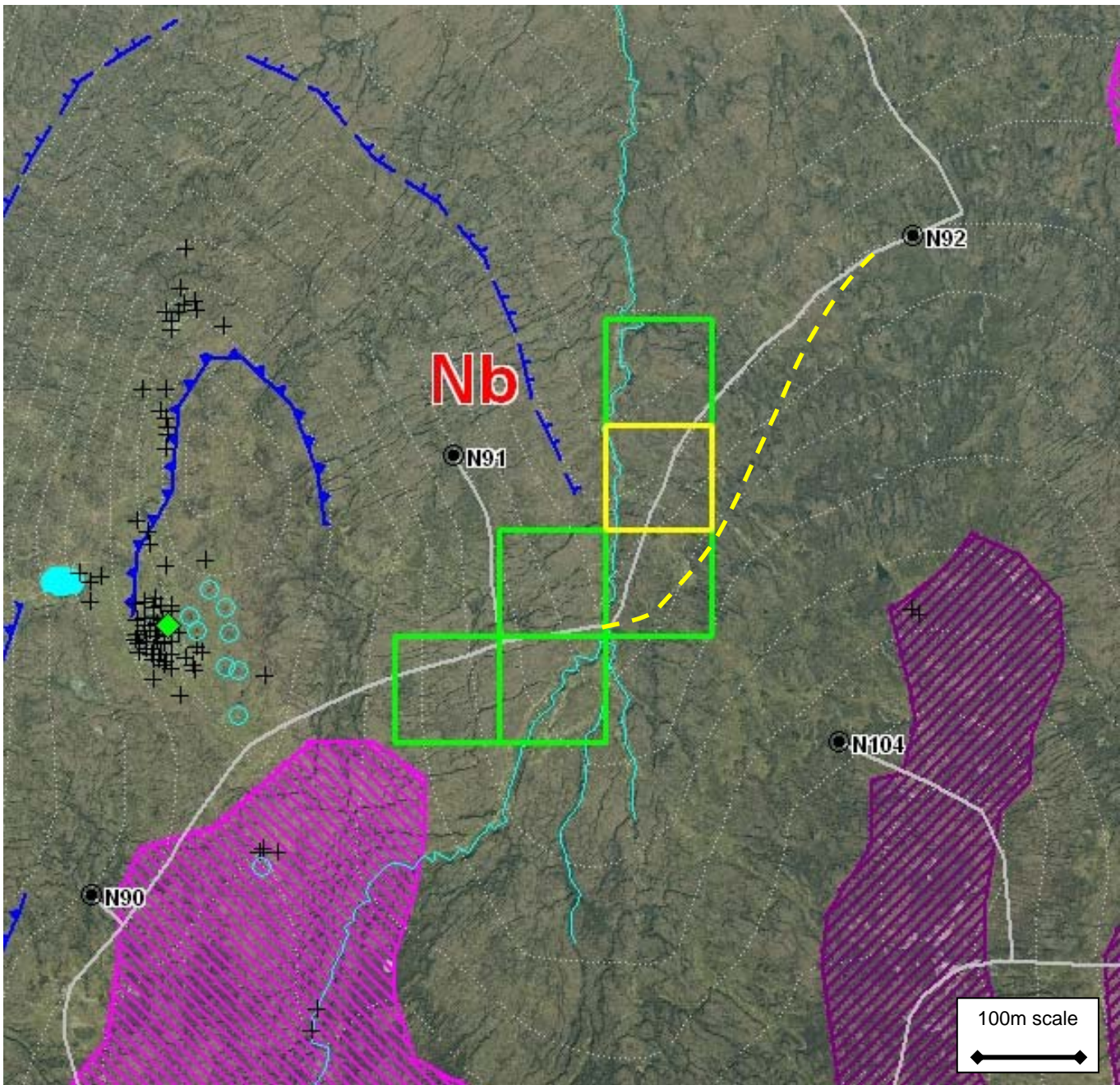
Mitigation
Floating track construction is recommended for areas of deep peat. Attention will be required in the track design to avoid disruption of subsurface flow within the peat. It is recommended that Turbine N98 is micrositied to the south-west to increase its distance from the indicated convex break in slope and to take advantage of gentler slopes in this area. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Nb

Grid Reference	HU 4240 6160	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 14	Depth (m)	-							
Max. Depth (m)	2.4	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.9	Primary receptor (stream order)	Easter Filla Burn (2)
Width (m)	450		
Down slide distance (m)	210	Secondary receptor (stream order)	Sae Water
Up slide distance (m)	280		
Volume (m³)	418,900		

**Comment / Description**

Location **Nb** lies within a moderately incised stream valley. Slope angles across this location tend to be fairly moderate, up to 14°. Measured peat depths across the area range from 0.5 to 2.4m with the deeper peat present along the valley floor immediately around the stream. The peat in this area was observed to be quite dissected by a series of drainage channels running downslope. No signs of instability were observed in the area. Although preliminary assessment highlighted this area as potentially at risk of peat landslide through the occurrence of deep peat and steep slopes within a single grid cell, upon closer inspection it was found that these were not coincident.

**Mitigation**

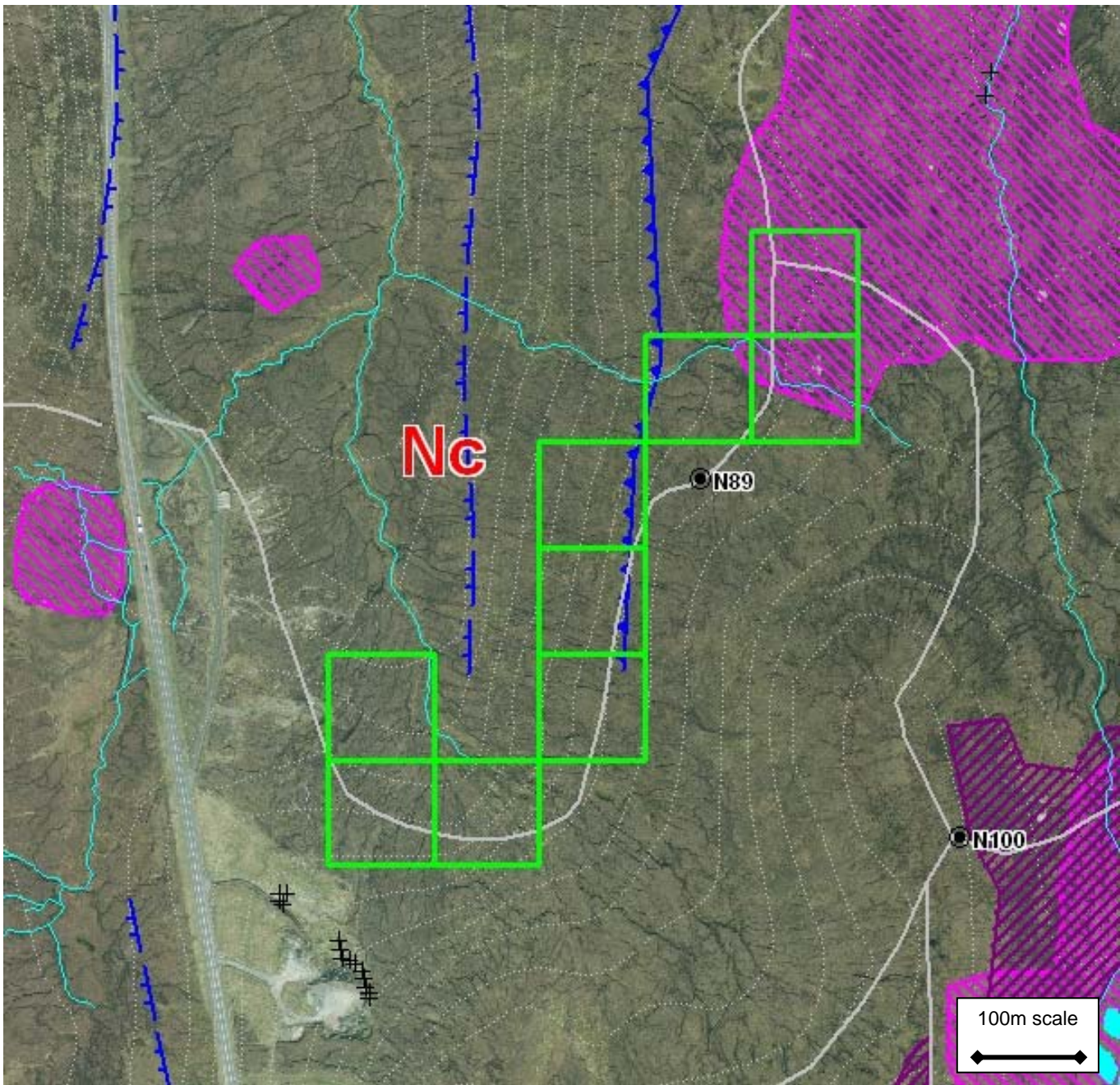
It is recommended that the track east of the stream is micrositied to the east to avoid the deeper and more broken peat immediately adjacent to the stream and to take advantage of the shallower slopes further up the hill. Floating track construction may be appropriate in areas of deeper peat. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	3	High Impact	12	Substantial
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Nc

Grid Reference	HU 4175 6065	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 19	Depth (m)	1.1	0.5	8.49	19.59	23.55	6.0	13.8	16.5
Max. Depth (m)	3.5	Bulk Density (Mg/m³)	1.30							
Min. FoS	6.0	Von Post classification	H3							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.1	Primary receptor (stream order)	Unnamed tributary to Wester Filla Burn (1)
Width (m)	240		
Down slide distance (m)	290	Secondary receptor (stream order)	Wester Filla Burn (3)
Up slide distance (m)	240		
Volume (m³)	267,100		

Comment / Description
Location <b>Nc</b> follows the head of a stream valley with slope angles for the most part no more than 12°. This area was visited as part of the reconnaissance survey and is documented as Area N1 in the Reconnaissance Survey section of this report. A convex break in slope has been identified near the northern part of the location; slopes below this are 12-15° and above are generally less than 10°. Peat probing data from the location indicate that peat depths range between 0.3 and 3.5m. The deepest peat is located in the northern section well above the break in slope. Peat on the steeper slopes and around the head of the valley is shallow to moderate in depth. Shear strength measurements for this location are quite variable, giving a range of FoS values. However, even the lowest of these falls within the fully stable band indicating that stability of the slopes is not a problem in this area. The bulk density of the peat is high, and the von Post classification indicates that the peat is only very weakly decomposed.

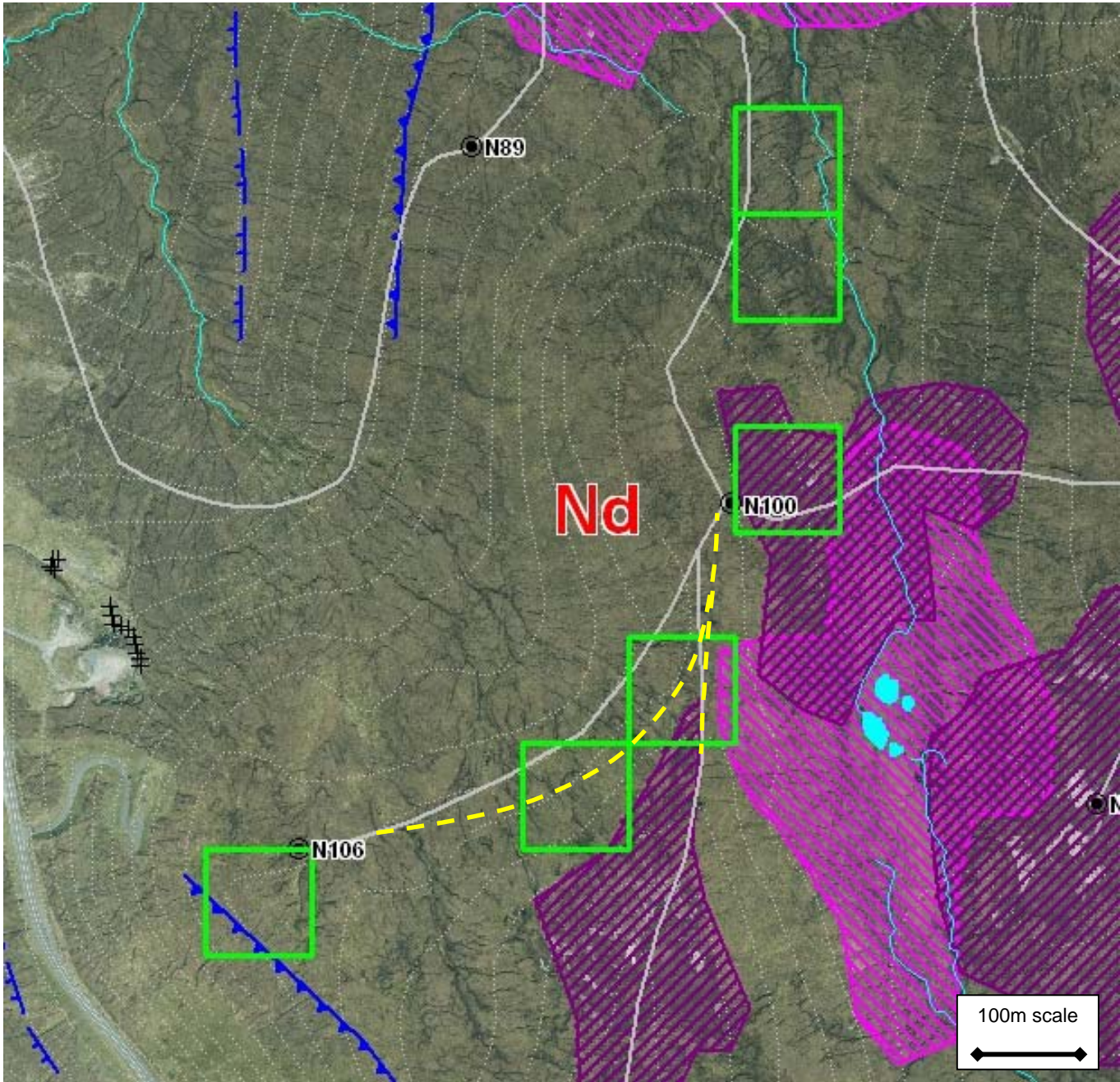
Mitigation
GI data from this site indicate that the risk of peat landslide is insignificant so no mitigation is required. Floating track construction is recommended for the deeper peat area at the northern end. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Nd

Grid Reference	HU 4210 6043	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 16	Depth (m)	-							
Max. Depth (m)	2.5	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.9	Primary receptor (stream order)	Unnamed tributaries to Easter & Wester Filla Burns (1) / A970
Width (m)	140		
Down slide distance (m)	200	Secondary receptor (stream order)	Easter & Wester Filla Burns (2,3) / Unnamed tributary to Petta Water (1)
Up slide distance (m)	100		
Volume (m³)	79,800		

Comment / Description
Location <b>Nd</b> falls on the crest and slopes of a long ridge. The peat along the ridge crest has been subject to considerable erosion and has been removed to mineral soil in some areas. Other sections are strongly dissected by gullies and channels. Measured peat depths are between 0.9 and 2.5m. Slopes are variable. Along the ridge crest they are typically gentle, around 4-6°, whilst on the sides are more often 10-12°. A convex break in slope lies south-west of Turbine N106 and slopes below this increase to 15° or more. This location was highlighted by the preliminary assessment for the combination of steep slopes and deep peat. However, closer inspection revealed that they are not coincident.

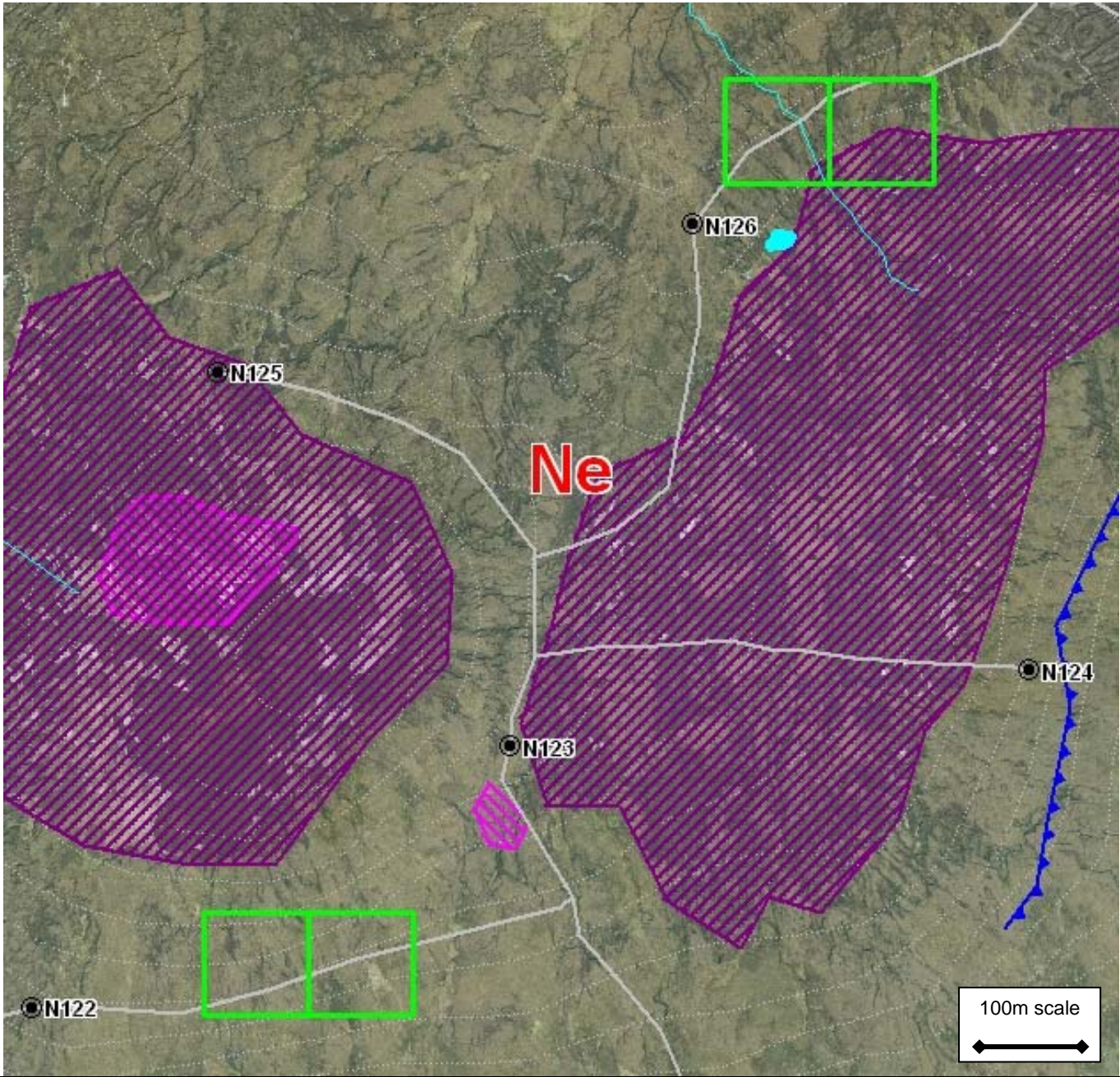
Mitigation
It is recommended that the main track line is microsites to the east to follow the ridge crest, taking advantage of the flatter slopes and degraded peat. It may also be prudent to microsite Turbine N106 to the north-east to increase its distance from the break in slope and site it on flatter ground. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Ne

Grid Reference	HU 4440 5877	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 12	Depth (m)	-							
Max. Depth (m)	2.6	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.0	Primary receptor (stream order)	Burn of Forse (2) / Unnamed tributary to Quinni Loch (1)
Width (m)	210		
Down slide distance (m)	300	Secondary receptor (stream order)	Burn of Grunnafirth (3) / Quinni Loch
Up slide distance (m)	250		
Volume (m³)	231,000		

**Comment / Description**

Location **Ne** forms two sections either side of a wide hilltop. Measured peat depths within the area range from 1.3 to 2.6m and slope angles are up to 12° although usually less than this. The stream in the northern section is incised into the peat, forming a steep-sided channel. Slopes away from this channel are more moderate. The southern section has small pockets of deeper peat within a wider area with shallow to moderate peat. Whilst the location has both fairly steep slopes and moderate to deep peat within each grid cell, detailed inspection indicates that these are not coincident so the risk of peat landslide is low.

**Mitigation**

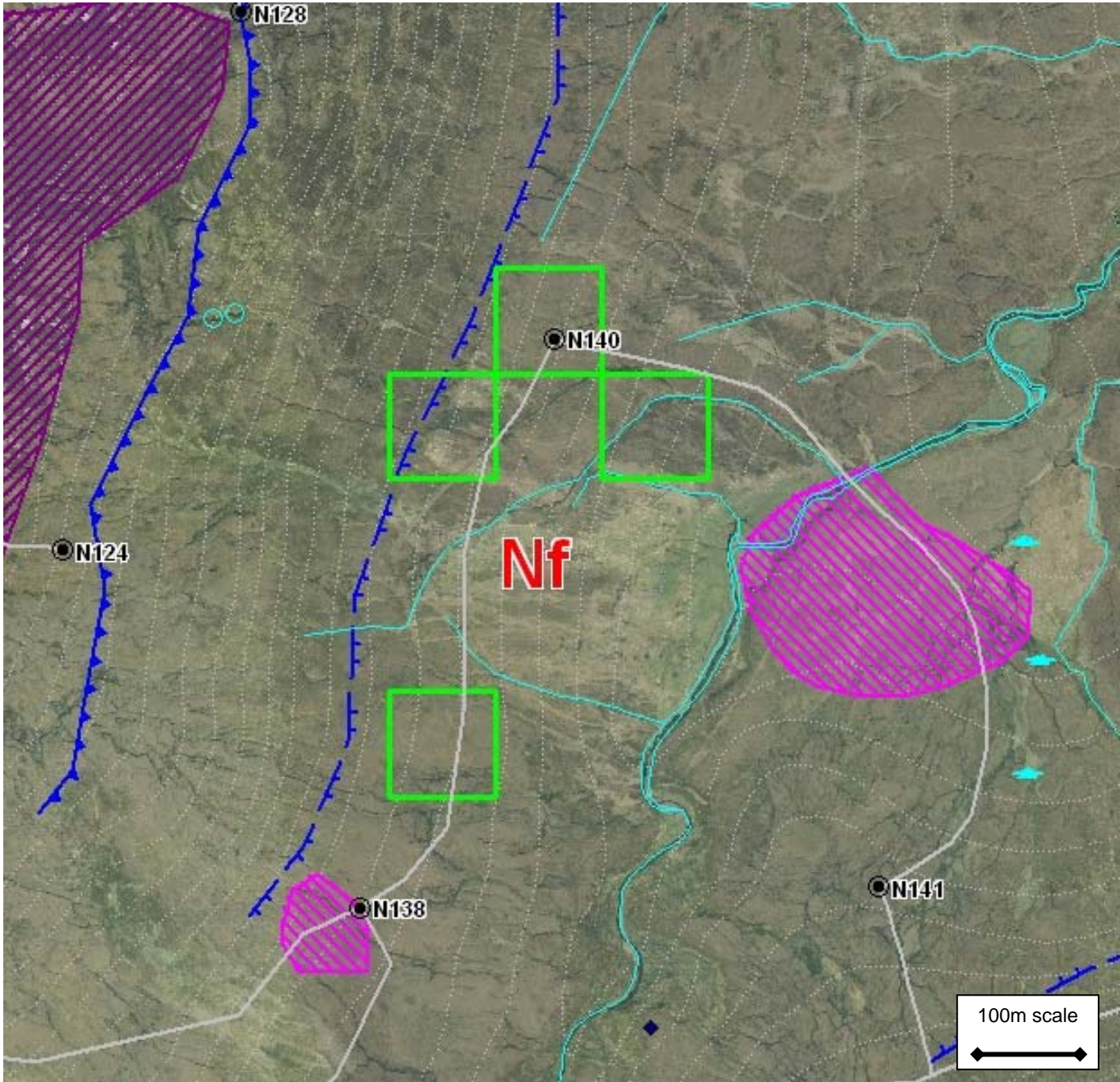
Although the detailed assessment indicates that the risk of instability is insignificant, it may be prudent to microsite the track in the southern section away from the pockets of deep peat during the detailed design stage. Care will be taken in the design of the watercourse crossing at the northern end to minimise crossing steep stream valley sides. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	2	Low Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Nf

Grid Reference	HU 4520 5870	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	3 – 10	Depth (m)	-							
Max. Depth (m)	1.8	Bulk Density (Mg/m <sup>3</sup> )	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.5	Primary receptor (stream order)	Burn of Forse (2)
Width (m)	100		
Down slide distance (m)	190	Secondary receptor (stream order)	Burn of Grunnafirth (3)
Up slide distance (m)	400		
Volume (m³)	88,500		

**Comment / Description**

Location **Nf** lies on the flank of a long slope just below a concave break in slope. Part of this area was visited during the reconnaissance survey and is documented as Area N4 in the Reconnaissance Survey section of this report. Slope angles below the break in slope are less than 9° whereas above this they are typically 10-12° or more. Measured peat depths are moderate, ranging between 1 and 1.8m. Closer inspection of peat depths within the immediate surroundings indicates that most peat in this area is less than 1m in depth; the measurements within the highlighted locations represent small isolated pockets of deeper peat. As the steeper slopes are not coincident with the deeper peat areas but lie at least 65m away, the risk of peat landslide is consequently lower than originally assessed.

**Mitigation**

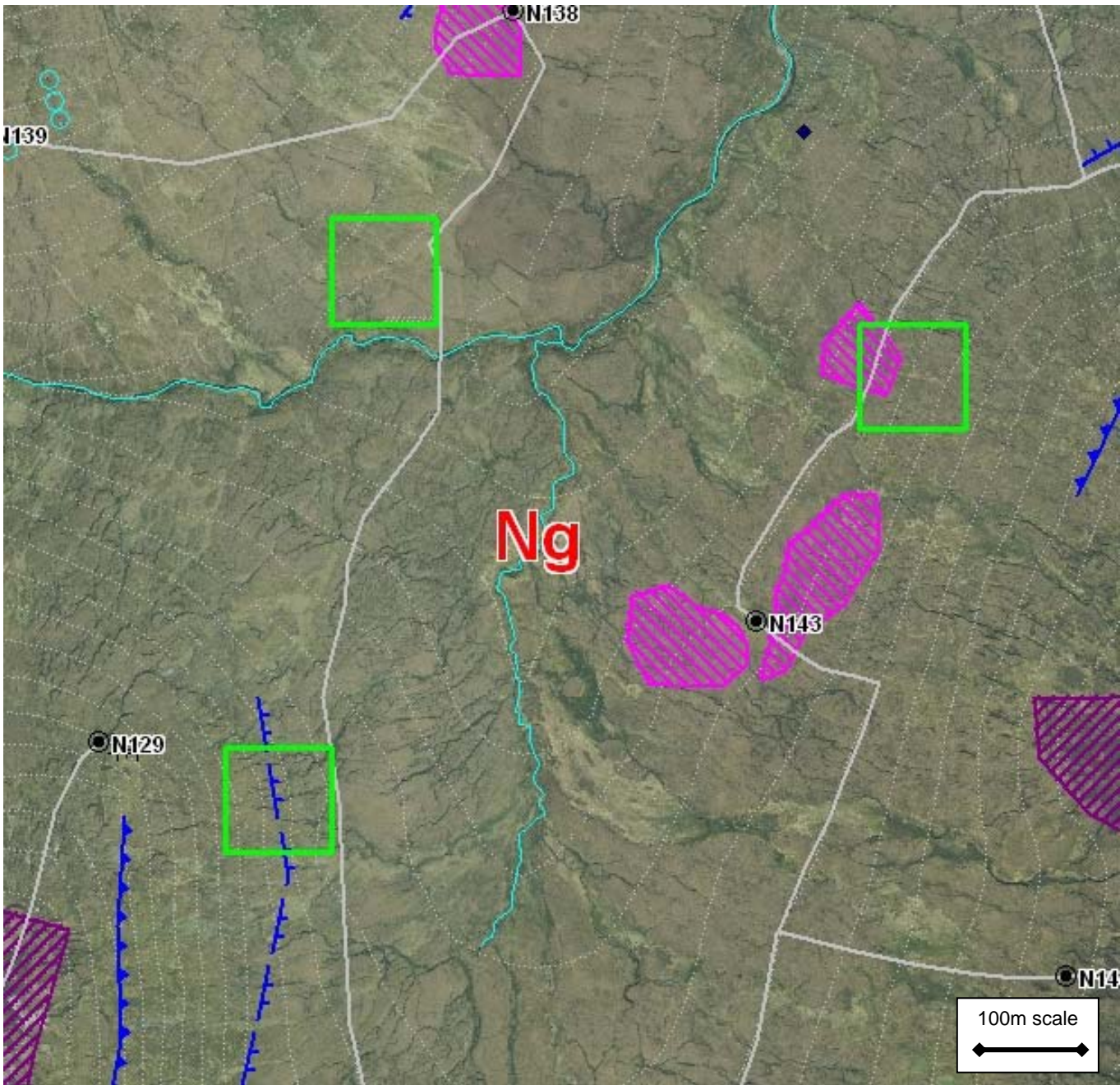
As the peat stability risk has been assessed as being insignificant, no mitigation is required. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant



LOCATION Ng

Grid Reference	HU 4500 5800	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 14	Depth (m)	-							
Max. Depth (m)	2.9	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.0	Primary receptor (stream order)	Burn of Forse (2) / Unnamed tributary to Burn of Forse (1)
Width (m)	90		
Down slide distance (m)	280	Secondary receptor (stream order)	Burn of Grunnafirth (3)
Up slide distance (m)	310		
Volume (m³)	106,200		

Comment / Description
Location <b>Ng</b> is situated on the slopes above a large burn. Part of this area was visited during the reconnaissance survey and is documented as Area N5 in the Reconnaissance Survey section of this report. The southern part of the location has a distinct concave break in slope uphill of the track line. Below this, slope angles are <10° whereas above the break they are 12° or more. The northern part of the location has slope angles up to 12° although slopes are mostly much more gentle. Peat probing within the location indicates that peat depths range from 1.2 to 2.9m although in the wider area peat is mostly less than 1m. Preliminary assessment highlighted this location as potentially at risk of peat instability through the presence of steep slopes and deep peat within each grid cell. However, detailed inspection revealed that they are not coincident.

Mitigation
There is insignificant risk of peat landslide in this location so mitigation is not required. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	2	Low Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant

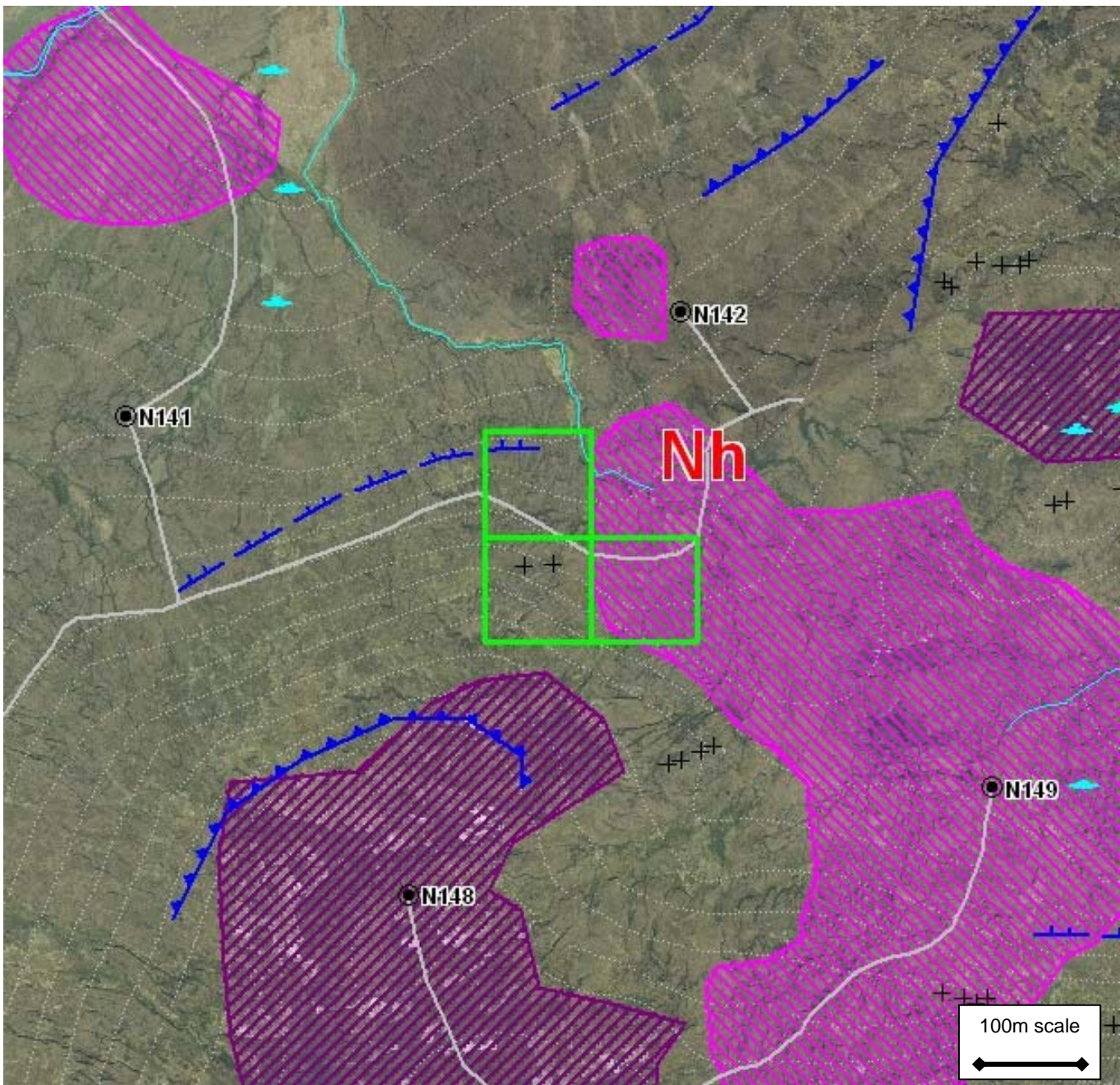


LOCATION Nh

Grid Reference	HU 4600 5820
Slope (°)	1 – 24
Max. Depth (m)	>4.0
Min. FoS	4.2

Peat Core	
Depth (m)	4.2
Bulk Density (Mg/m³)	1.19
Von Post classification	H8

Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
0.5	22.16	20.32	-	38.4	35.2	-
1.5	14.71	13.10	-	8.6	7.7	-
2.5	11.81	12.67	-	4.2	4.5	-
3.5	22.46	21.43	-	5.7	5.4	-



Estimated Peat Slide Parameters

Estimated average peat depth (m)	2.9	Primary receptor (stream order)	Unnamed tributary to Burn of Grunnafirth (1)
Width (m)	220		
Down slide distance (m)	170	Secondary receptor (stream order)	Burn of Grunnafirth (3)
Up slide distance (m)	230		
Volume (m³)	255,200		

Comment / Description

Location **Nh** follows the flanks of a wide hill, near the headwaters of a small watercourse. This area was visited during the reconnaissance survey and is documented as Area N4 in the Reconnaissance Survey section of this report. Measured peat depths are 2m or more across this whole area, with the deepest peat around the head of the watercourse. Slope angles are variable, mostly 10° or less, although slopes up to 24° are present in restricted parts of the location. This location was highlighted in the preliminary assessment owing to the presence of deep peat and steep slopes within the same grid cell. Closer inspection has indicated that these are not coincident and areas of steep slope are fairly restricted. Peat was fairly dry underfoot, dissected by drainage channels in places, but no signs of instability were observed.

Mitigation

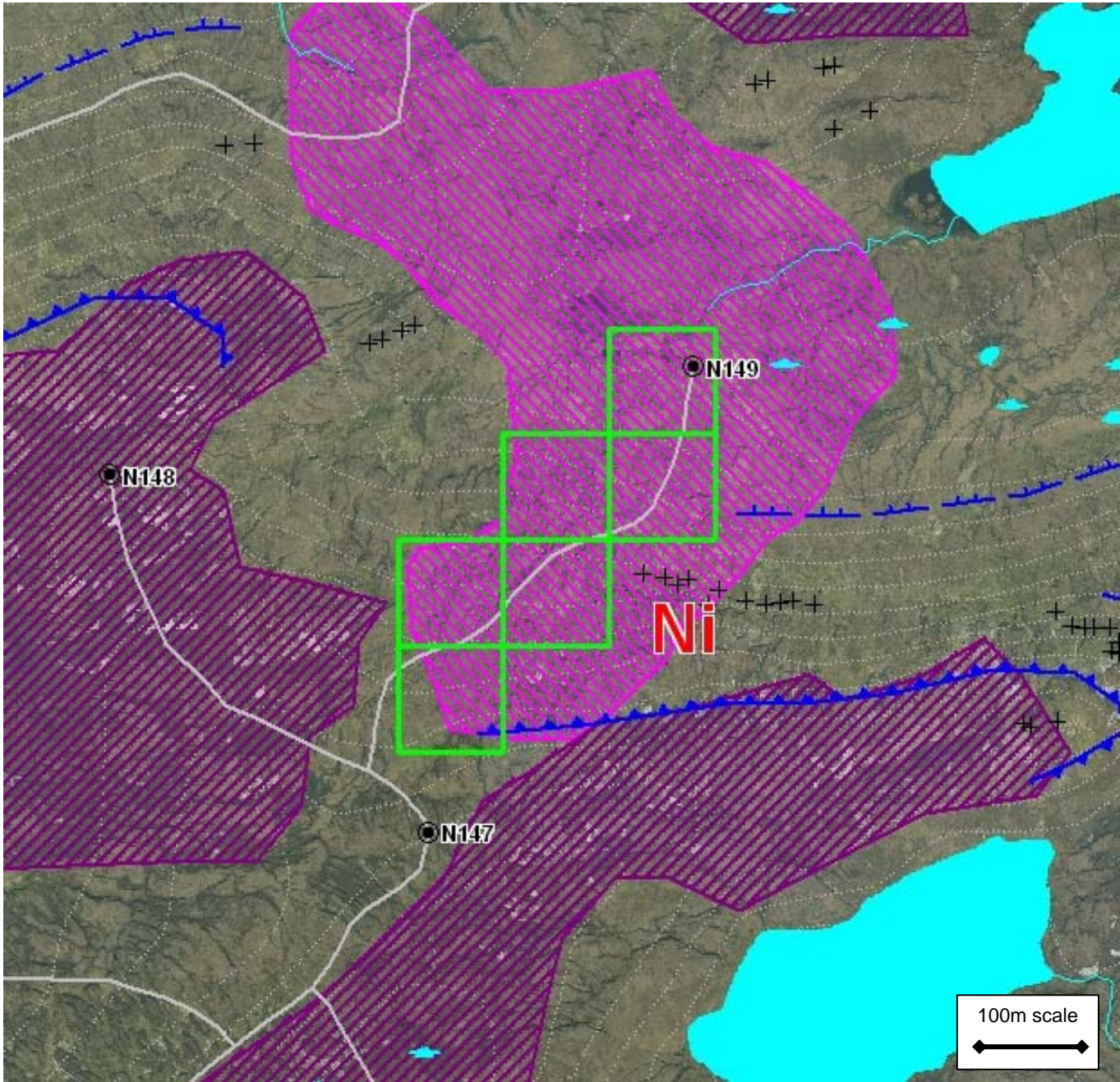
Floating track construction is recommended for this location, especially for the area of deep peat indicated in the accompanying figure. Care will be required in the track design to ensure that subsurface flow within the peat is not disrupted. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	1	Negligible	2	Low Impact	2	Insignificant



LOCATION Ni

Grid Reference	HU 4627 5780	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 13	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	3.0	Primary receptor (stream order)	Unnamed tributary to Loch of Bellister (1)
Width (m)	60		
Down slide distance (m)	550	Secondary receptor (stream order)	Loch of Bellister
Up slide distance (m)	230		
Volume (m³)	140,400		

Comment / Description
Location <b>Ni</b> lies down the side of a long ridge leading to a flat marshy area. Part of this area was visited during the reconnaissance survey and is documented as Area N4 in the Reconnaissance Survey section of this report. Slope angles across the location are generally fairly modest, in most parts being <10° although in one section slopes of up to 13° have been recorded. Peat probing indicates that peat depths range from 0.6 to >4m, with much of the location having peat in excess of 2m deep. Parts of the steeper slope to the south-east have been eroded to mineral soil with exposed bedrock in places. Remaining peat is fairly thin although dissected by drainage channels. Peat along the slopes was dry underfoot, with more boggy ground present on the flatter slopes around Turbine N149.

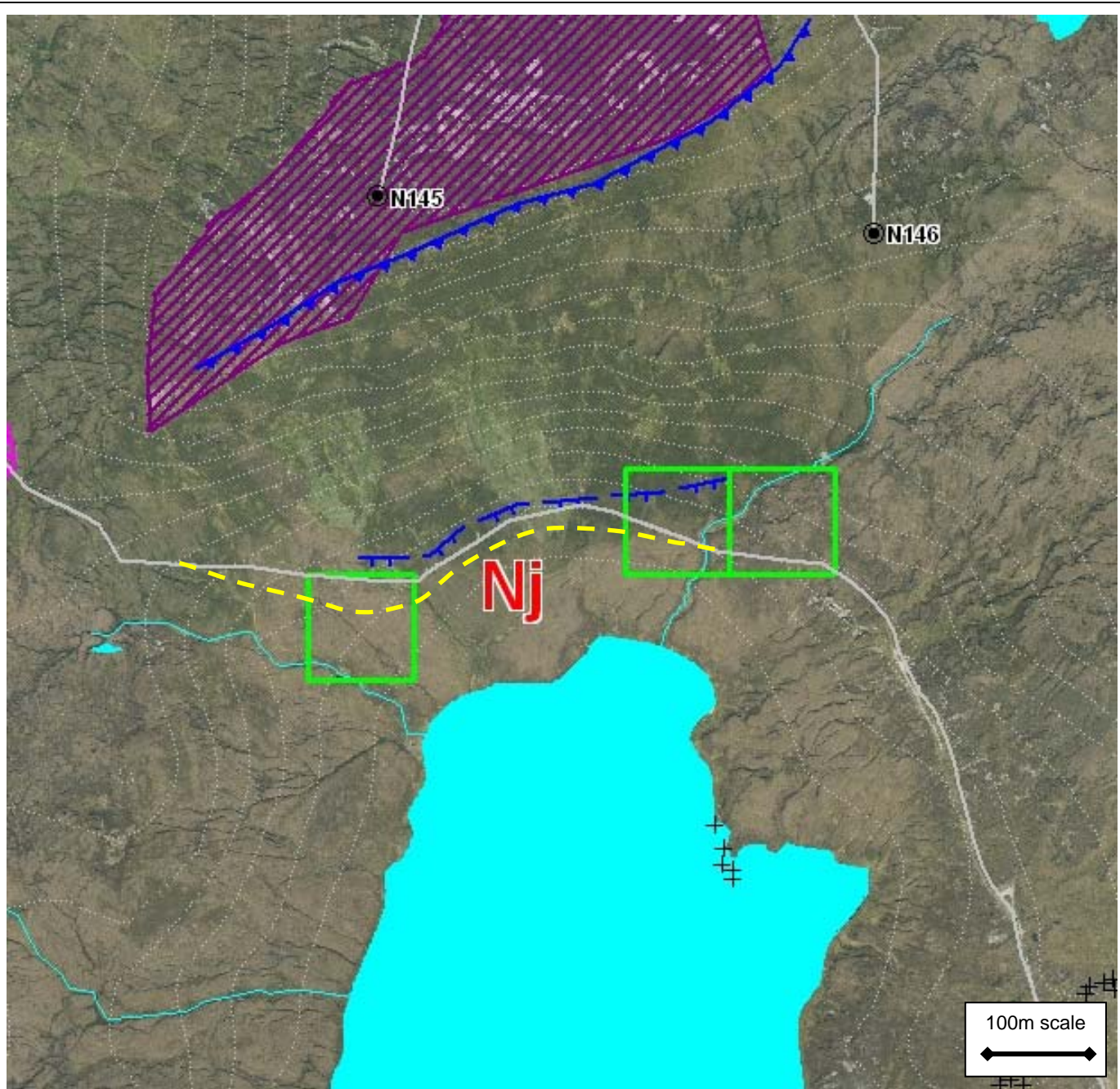
Mitigation
It is recommended that floating track construction is used across this location. Care will be required in the track design to ensure that subsurface flow within the peat is not disrupted. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	4	Probable	2	Low Impact	8	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Nj

Grid Reference	HU 4600 5666	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	1 – 16	Depth (m)	1.1	0.5	12.52	11.43	12.41	13.8	12.6	13.7
Max. Depth (m)	3.0	Bulk Density (Mg/m³)	0.98	1.1	8.11	4.23	8.06	4.1	2.1	4.0
Min. FoS	2.1	Von Post classification	H5-H6							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.6	Primary receptor (stream order)	Loch of Skellister
Width (m)	210		
Down slide distance (m)	100	Secondary receptor (stream order)	Mill Burn (2)
Up slide distance (m)	370		
Volume (m³)	157,900		

Comment / Description
Location Nj follows a concave break in slope around the northern end of a loch. The track line has been routed to take advantage of the gentler slopes below the break in slope, which are mostly 8-10°. Above the break in slope, the angles increase to 15° or more, whilst slopes nearer the loch are 3° or less. The slope aspect indicates that should a failure occur it would slide to the south-east, towards the flat ground, rather than impacting on the watercourses. Measured peat depths range from 0.9 to 3m. Measured shear strengths for this location are quite variable, with comparatively low value. This gives a range of FoS values for the site, including one comparatively low one of 2.1 which is lower than expected. Even this, however, indicates that the slope is stable. The peat at this location has a bulk density less than water, indicating it may include woody material. The von Post classification indicates that the peat is moderately to strongly decomposed.

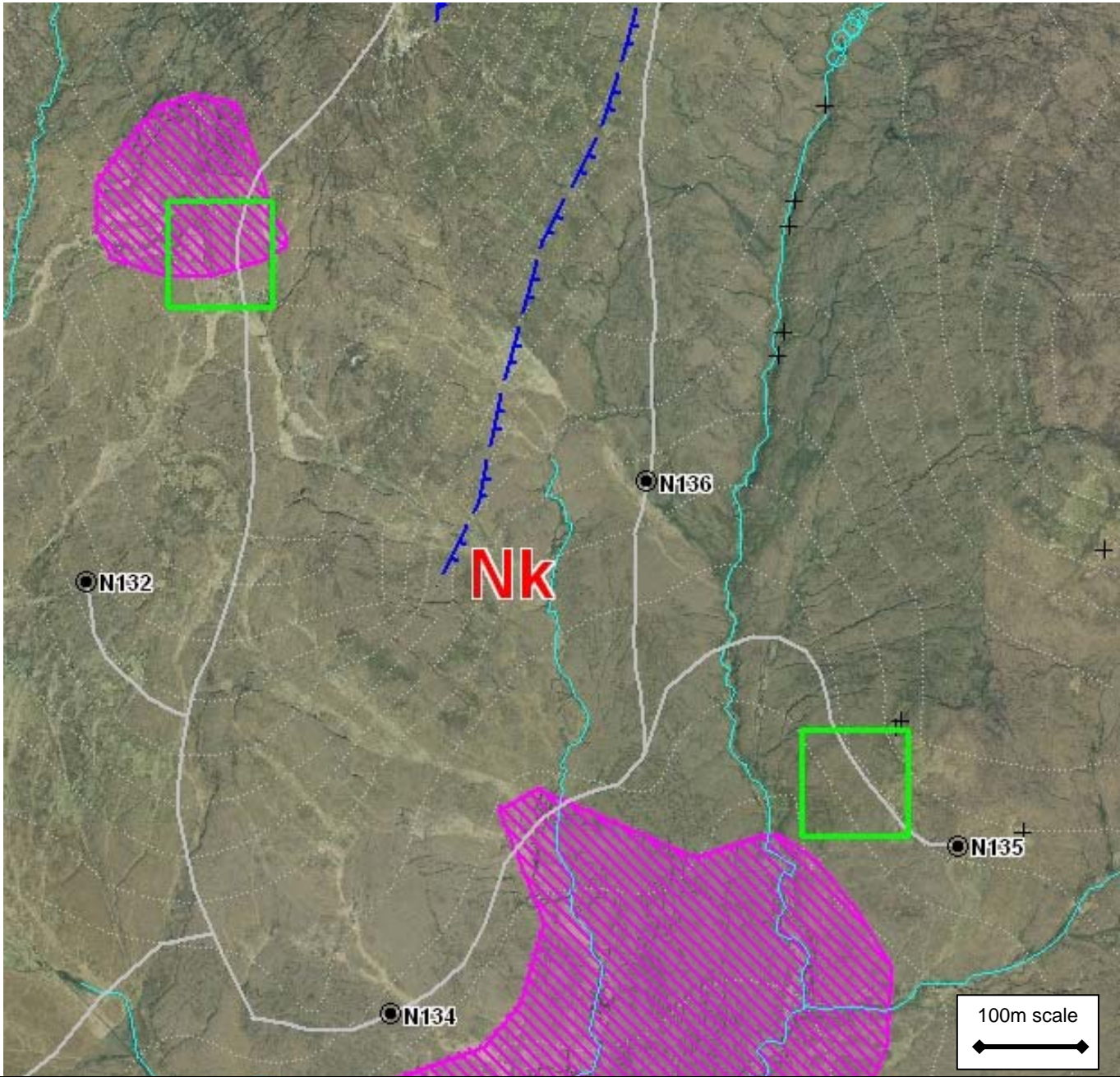
Mitigation
Micrositing of the track further from the break in slope is recommended, to minimise the possibility of removing toe support from the slope and to take advantage of the flatter slopes in this area. No further mitigation is required at this stage. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Nk

Grid Reference	HU 4463 5616	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	1 – 13	Depth (m)	-							
Max. Depth (m)	>4.0	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.2	Primary receptor (stream order)	Burn of Flamister (1) / Burn of Quoys (1)
Width (m)	120		
Down slide distance (m)	110	Secondary receptor (stream order)	Burn of Catfirth (3) / B9075
Up slide distance (m)	140		
Volume (m³)	66,000		

**Comment / Description**

Location **Nk** is situated on south and south-west facing slopes, with angles up to 13° in parts of the grid cells. Measured peat depths within the location range from 1.4 to >4m but in both cases the deeper peat measurements represent fairly small isolated pockets. The northern pocket is larger than the southern, but situated on an area with slope angles of less than 6°. Steeper slopes in the southern part of the location lie above the proposed track alignment but are not coincident with the small area of deeper peat within the cell.

**Mitigation**

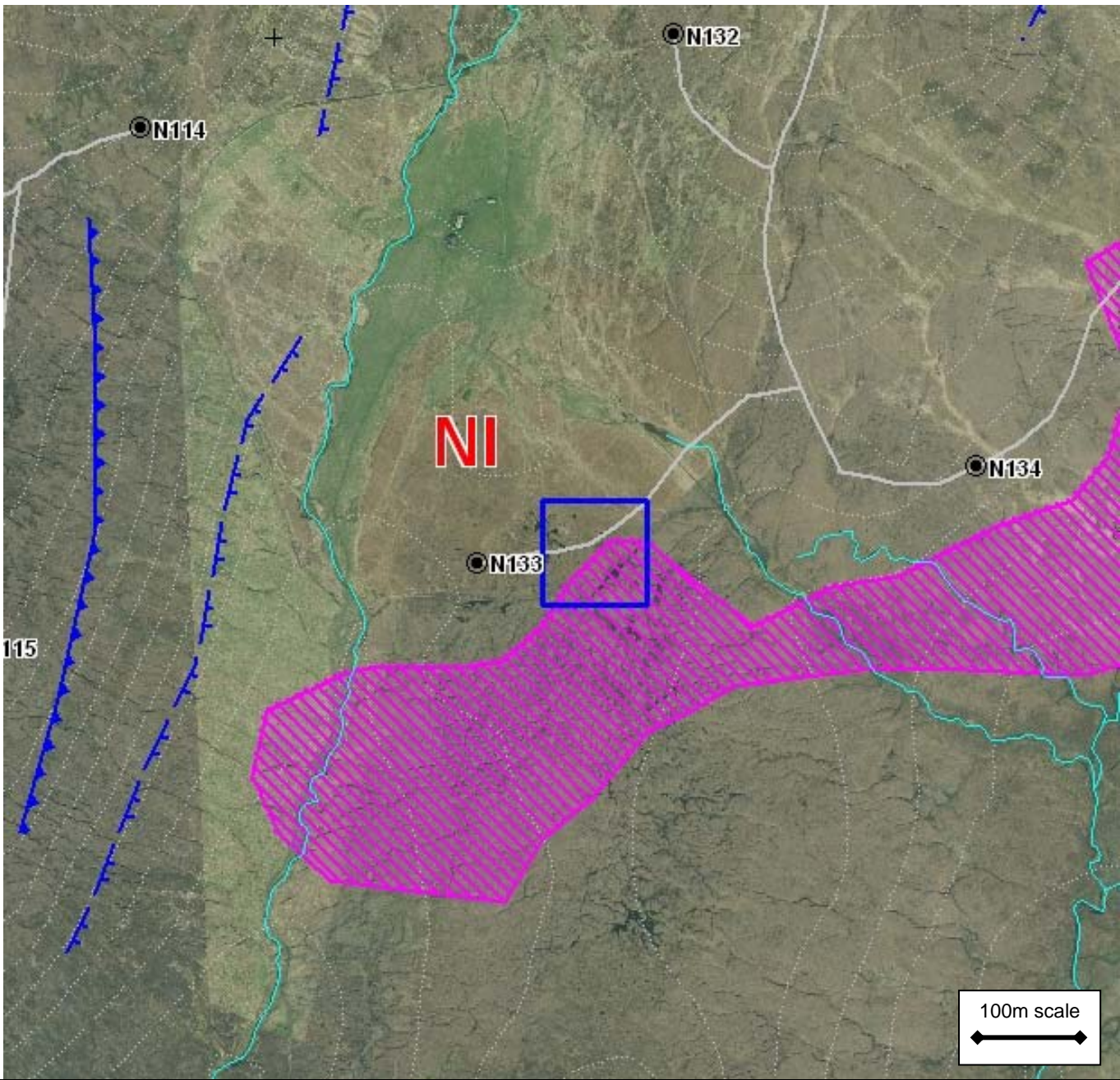
Micrositing the track sections is recommended to avoid or minimise crossing areas of deeper peat. Floating track construction may be required for the area of deeper peat at the northern end. Care should be taken to ensure that subsurface flow within the peat is not disrupted. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	2	Low Impact	6	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION NI (control)

Grid Reference	HU 4413 5556	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 3	Depth (m)	2.5	0.5	9.97	9.69	10.96	124.3	120.9	136.6
Max. Depth (m)	3.6	Bulk Density (Mg/m³)	1.04	1.5	13.88	16.97	15.06	57.8	70.6	62.7
Min. FoS	24.4	Von Post classification	H8	2.5	13.88	14.73	14.48	34.8	36.9	36.3



Estimated Peat Slide Parameters

Estimated average peat depth (m)		Primary receptor (stream order)	
Width (m)			
Down slide distance (m)		Secondary receptor (stream order)	
Up slide distance (m)			
Volume (m³)			

Comment / Description

Location NI lies on the southern side of a broad, flat col. Slope angles range from 0 to 3°. Peat probing in the area indicates that peat is mostly deep, typically in excess of 2.5m. GI work in the area gave variable but typically fairly high shear strength values. Calculated FoS values for the location are high, indicating the peat here is very stable. The bulk density is moderate, slightly higher than water, and the von Post classification indicates that the peat is strongly decomposed.

Mitigation

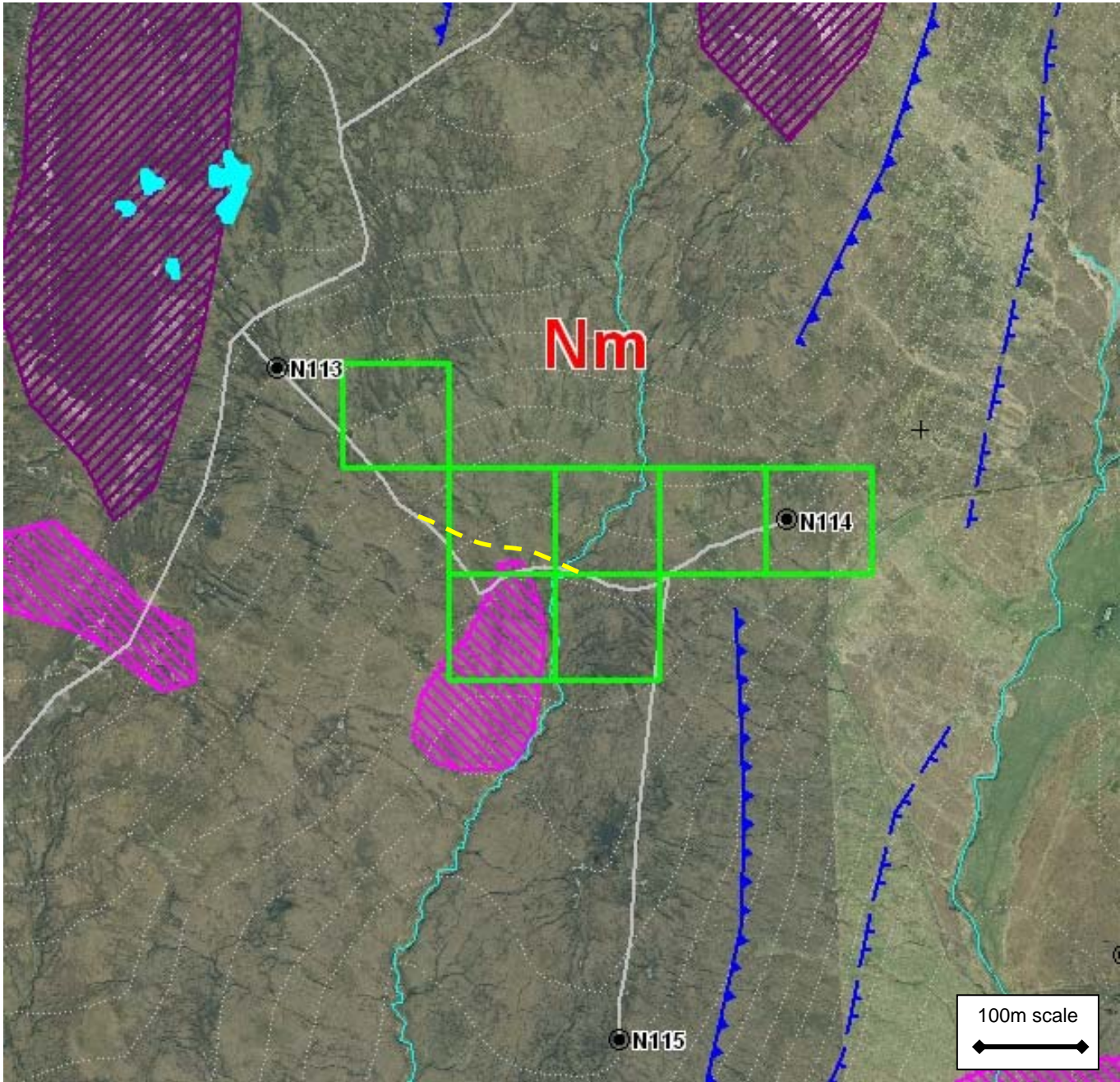
As there is insignificant risk of peat instability at this location no mitigation is required. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	1	Negligible	2	Low Impact	2	Insignificant
Final	1	Negligible	2	Low Impact	2	Insignificant



LOCATION Nm

Grid Reference	HU 4350 5590	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 20	Depth (m)	-							
Max. Depth (m)	3.4	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	1.9	Primary receptor (stream order)	Gill Burn (1) / Burn of Flamister (2)
Width (m)	200		
Down slide distance (m)	230	Secondary receptor (stream order)	Burn of Catfirth (3)
Up slide distance (m)	340		
Volume (m³)	216,600		

**Comment / Description**

Location **Nm** lies within a shallow stream valley. Slope angles are variable, up to 20° in places although generally less than 8° except immediately around Turbine N114. Measured peat depths are also variable, ranging from 0.4 to 3.4m with deeper peat present within the stream valley. Owing to the slope aspect, any failure that were to occur would slide to the south, along the valley, rather than impacting on the watercourse. The peat in this area is mostly fairly intact, except at the higher levels near Turbine N113 where it has been dissected by a series of drainage channels. This location was highlighted as being a potential risk area by the preliminary assessment owing to the occurrence of deep peat and steep slope angles within the same grid cells. Closer inspection revealed that these are not coincident, indicating that the risk of instability is lower than thought.

**Mitigation**

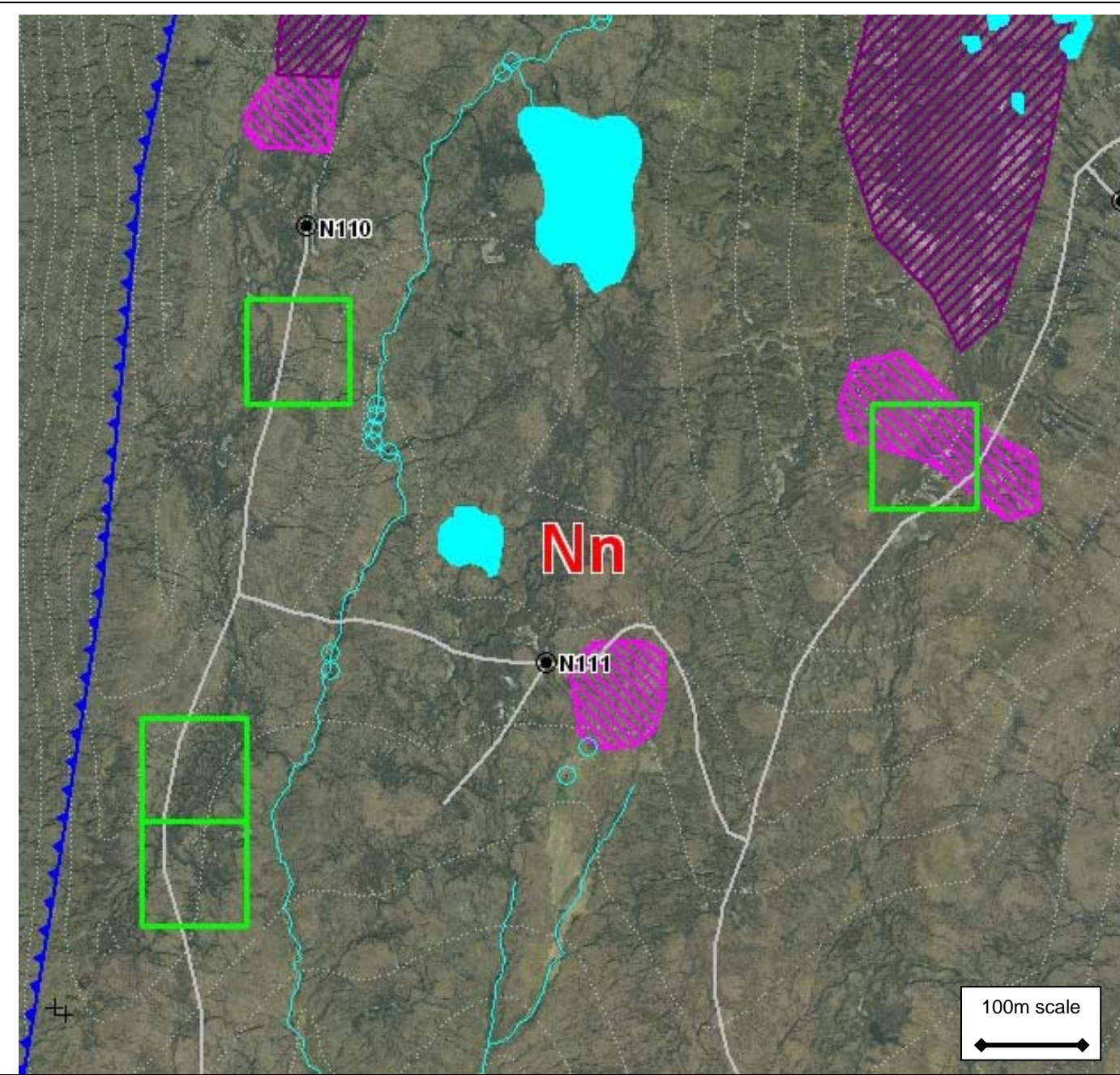
Micrositing of the track to avoid the area of very deep peat is recommended. It may be prudent to use floating track construction through the stream valley where deeper peat has been recorded, although care should be taken not to disrupt subsurface flow within the peat. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	3	Likely	3	High Impact	9	Significant
Final	2	Unlikely	2	Low Impact	4	Insignificant



LOCATION Nn

Grid Reference	HU 4278 5569	Peat Core		Depth (m)	Shear 1 (kPa)	Shear 2 (kPa)	Shear 3 (kPa)	FoS 1	FoS 2	FoS 3
Slope (°)	<1 – 15	Depth (m)	-							
Max. Depth (m)	3.1	Bulk Density (Mg/m³)	-							
Min. FoS		Von Post classification	-							



Estimated Peat Slide Parameters			
Estimated average peat depth (m)	2.1	Primary receptor (stream order)	Burn of Crookadale (2)
Width (m)	200		
Down slide distance (m)	300	Secondary receptor (stream order)	Burn of Catfirth (3)
Up slide distance (m)	150		
Volume (m³)	189,000		

**Comment / Description**

Location **Nn** is situated on the flanks of a long ridge line. Although a distinct concave break in slope has been identified to the west of the location, proposed infrastructure is at least 95m away and will not be affected by the change in slope angle. Slopes within the location are up to 15° although they are generally around 8°. Peat probing indicates that peat depths range between 0.2 and 3.1m, with both extremes occurring within 50m. This variability indicates that deep peat occurs in small and isolated pockets, although a slightly larger area of deep peat has been highlighted at the eastern side of the location.

**Mitigation**

As the risk of peat instability is insignificant, no mitigation is necessary. However, it may be prudent to use floating track construction in the highlighted area of deeper peat at the eastern part of the location. Micrositing to avoid small pockets of deep peat may be required in other areas. The risk should continue to be re-appraised throughout the detailed design stage and monitoring undertaken by a qualified geotechnical engineer throughout the construction phase.

	Hazard Rating		Exposure Rating		Hazard Ranking	
Initial	2	Unlikely	3	High Impact	6	Significant
Final	1	Negligible	3	High Impact	3	Insignificant