6

Ecology

Part 1a: Description of Vegetation Compartments

Compartment 1

1. This area consists of low-lying ground which forms the south-western 'leg' of the application area, and is described from the southern limit of the application area moving northwards. T8, T9, T10 and T11 are situated along this section of the site.
2. The southern-most part of the site consists of four blocks of mature Sitka Spruce plantation separated by bands of species-poor MG10 *Holcus lanatus-Juncus effusus* rush-pasture which are grass-dominated (*Holcus lanatus* to 95% cover) with only one or two mesotrophic forbs, *Trifolium repens* and/or *Cerastium fontanum*, recorded. These areas have been subjected to some degree of agricultural improvement which has resulted in dense, species-poor swards which also lack bryophytes (Q33 & Q34).
3. MG10 rush-pasture also grades into a mosaic with M23b *Juncus effusus-Galium saxatile* rush-pasture in this part of the site, particularly where forestry margins coincide with water-filled ditches although a low-lying hollow to the immediate south of the northern-most forestry block supports a very small area of M20 *Eriophorum vaginatum* mire (Q32). The same forestry block also supports a small lake an area of M19 *Calluna vulgaris-Eriophorum vaginatum* mire/M25 *Molinia caerulea-Potentilla erecta* mire mosaic along its eastern margin, although this area was not subjected to NVC survey.
4. Species-poor MG10 rush-pasture extends to the west of the forestry blocks (Q35 – Q37) and also to the north (Q30 & Q31), where again they grade into occasional mosaics with M25 rush-pasture and/or M23b rush-pasture (Q38). Moving northwards, the dominance of species-poor MG10 rush-pasture (Q27 – Q30) is broken once by a north-west to south-east oriented band of M15 *Scirpus cespitosus-Erica tetralix* wet heath/M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire/M25 rush-pasture (Q26), this mosaic created in part by variations in the depth of underlying peat.
5. MG10 rush-pasture continues north beyond the heath/mire/rush-pasture mosaic (Q22 – Q25) and grades into two areas of M15 wet heath along its eastern margin, which continue to the east and north-east of the application boundary where they are more or less contiguous with wet heath and mire habitats representing a natural hollow in the landscape, the centre of which is marked by a small upland lake. Some deeper areas of peat near the south-western lake margins have been cut-over in the past.
6. With slightly increasing elevation, increased slope angle and thinner soils, MG10 rush-pasture grades into U5 *Nardus stricta-Galium saxatile* grassland which can be relatively species-rich in places (Q19) although graminoid, forb and bryophyte species diversity all decline sharply as grazing pressure increases in this area (Q20 & Q21). A small block of Sitka Spruce plantation is also present within this area of acid grassland.
7. U5 grassland soon gives way to more species-poor MG10 rush-pasture as the southern 'leg' of the application area curves to the north-east and east of the lake and its associated areas of wet heath and mire, forming a very extensive area dominating much of this central part of the application area (Q16 – Q18, Q39, Q62 & Q63). Parts

of the sward are very heavily poached and grazed, owing to a concentration of sheep and/or cattle in this relatively sheltered, grass-dominated part of the site.

8. The southern limit of this rush-pasture is marked by a mosaic of wet heath and mire (Q15) associated with the nearby lake; its south-eastern limit is marked by a north-south band of M23a rush-pasture/U4 acid grassland mosaic (Q13 & Q14).

Compartment 2

9. This area is defined as the south-eastern 'leg' of the application area which connects the wider site to the entrance along the A42 Carnlough/Ballymena Road. It is described from where it adjoins Compartment 1 (at Q2 & Q13) to the south-east. No turbines are situated along this section of the application boundary however it provides the main access road leading west-south-west from the A42 Carnlough/Ballymena Road as well as the Temporary Enabling Works Compound.

10. A mosaic of extensive M23a rush pasture/U4 acid grassland is present a short distance to the south-east of the proposed control building & substation location (Q3 – Q6, Q8 & Q13) where *Juncus acutiflorus* is the dominant species (to 80% cover). Some agricultural improvement is evident within the sward as *Trifolium repens* and/or *Juncus effusus* can be abundant. Small areas of species-poor MG10 rush-pasture also occasionally extend into this mosaic from the north (Q2) and from the south-west (Q7). Peat depth in this area is sufficient to support blanket mire (excepting its north-eastern margins) and towards the south-eastern limit of this habitat mosaic, a small quantity of mire species are present (Q8) within the sward as it grades into an area of M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire (Q9). This area of blanket mire is relatively small in extent at c.3.7ha and is proposed as the site for the Temporary Enabling Works Compound. Scattered plants of *Succisa pratensis* are present at and in the wider vicinity of Q8.

11. Beyond the area of M19 blanket mire, the application boundary changes to a north-eastern orientation and encompasses a series of field units supporting MG7 *Lolium perenne* leys and related grasslands with scattered Gorse *Ulex europaeus* scrub and occasional Hawthorn *Crategus monogyna*. The northern and south-western margins of this improved field complex support small expanses of species-poor M23b *Juncus effusus-Galium palustre* rush pasture/MG10 *Holcus lanatus-Juncus effusus* rush-pasture (Q10 & Q11).

12. The south-eastern boundary of the improved grassland field complex supports a significant area of species-rich M23a *Juncus acutiflorus-Galium palustre* rush-pasture (Q12) which is the most species-rich example of this NI Priority Habitat present on site with a total of 18 species recorded. The area is rich in graminoids (N = 12) and *Juncus acutiflorus* is co-dominant with *Jacobaea aquaticus* and *Ranunculus flammula*.

13. The eastern margin of the improved field complex is marked by a narrow band of W9 *Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* woodland where *Fraxinus excelsior* and *Corylus avellana* are the dominant woody species. The proposed access track extends to the A42 Carnlough/Ballymena Road through this woodland.

Compartment 3

14. Compartment 3 comprises a 'leg' of the application boundary which extends to the north of the site and follows the eastern limit of the Antrim Plateau, representing the eastern-most of three 'legs' which extend northwards across the site. T1, T2, T3 and T5 are situated along this section of the site. The compartment is described from south to north.

15. The southern portion of this 'leg' of the application site consists of an extensive area of species-poor MG10 rush-pasture (Q1 & Q95) which grades into areas of M23a rush-pasture/U2 acid grassland mosaic and MG10/M23a rush-pastures with M25 *Molinia caerulea-Potentilla erecta* mire along some of its margins. Grazing pressure in this area is high, with both sheep and cattle are present.

16. To the north, the sward grades into a complex mosaic of MG10 rush-pasture/U2 *Deschampsia flexuosa* grassland to the east and into M25 rush-pasture to the west which also supports a small area of H10a *Calluna vulgaris-Erica cinerea* heath (Q94). M25 habitat extends as far north as the field boundary, beyond which a mosaic of U2 *Deschampsia flexuosa* grassland/H10a dry heath (Q90) is present for a short distance as a west-to-east directed band. Dry heath is likely present here due to a combination of the sloping topography, the shallow, south-oriented soils and relatively low grazing pressure. This combination of variables is not repeated often across the site and so dry heath is very limited in extent.

17. With a levelling of the local topography and local variations in peat depth, the U2/H10a mosaic grades into a more complex mosaic of M15 wet heath/M17 blanket mire/M19 blanket mire and M25 mire (Q89) which may have been subjected to a disturbance event such as fire in the recent past owing to the presence of bare peat and the colonising bryophytes *Campylopus introflexus* and *Polytrichum piliferum*. This wet heath and mire mosaic extends north for a short distance until increasing slope angle and shallower soils result in a transition into two small blocks of U2 acid grassland/H10a dry heath and an extensive mosaic of MG10/M23a/M25 rush-pastures (Q86 - Q88) which encompasses the proposed location for T3 and also extends to the west, across the area occupied by T5 and its associated infrastructure (Q93).

18. At the northern extent of this rush-pasture habitat complex, the proposed access track veers from north to north-east towards T1, where it enters an extensive band of MG10 rush-pasture (Q83 – Q86) which is situated over thin peat and subjected to moderate grazing pressure. Ground occasionally slopes to the south in the same area, resulting in the localised presence of M23a rush-pasture.

19. MG10 rush-pasture extends a short distance beyond T1 to the north-east and north-west; in the latter instance a levelling of slope and variations in the depth of underlying peat creates a transition into a complex mosaic of M15 wet heath/M17 blanket mire/M20a blanket and raised mire/U2 acid grassland (Q79 – Q82) which extends to the northern site boundary and mid-way between T2 and T4.

20. To the immediate west, more varying slope angle and peat depth change the composition of the mosaic and although M15 wet heath and U2 acid grassland remain,

M17 and M20a mire habitats are replaced by M25 mire, although the northern margin of this mosaic begins to take on M17 mire characteristics close to the northern site boundary and a number of scattered bog pools are present which support M3 *Eriophorum angustifolium* bog pool community (Q78). Grazing pressure in this area is high as evidenced by stunted *Calluna* plants and the presence of *Juncus squarrosus*. An irregularly-shaped area of species-poor MG10 rush-pasture is also present within this mosaic (Q77) which is cattle-grazed.

Compartment 4

21. This compartment comprises the area to the west of Q77 where the proposed location for T4 is situated; it is described from T4 southwards.

22. The U2 acid grassland/M15 wet heath/M25 mire mosaic described above grades westward into M15 wet heath/M17 mire at and around the location of T4, this mosaic being a result of varying peat depths despite the vegetation being fairly uniform on the surface (Q75). Grazing pressure in this area is low. With increasing peat depth and grazing pressure to the south, the M17 element of the mosaic is replaced with M20a where *Eriophorum vaginatum* tussocks dominate the vegetation interspersed with localised areas of M15 wet heath where peat depth is shallow (Q74).

23. Shallow soils to the immediate east support a swathe of U5 *Nardus stricta-Galium saxatile* grassland (Q76) which extends a short distance to the south as a narrow vein alongside a mosaic of M15 wet heath and U2 *Deschampsia flexuosa grassland* (Q73) to the west and a narrow, oblique band of M23a rush-pasture with scattered elements of acid grassland to the east which extends as far south as the southern half of the proposed location for T6 (Q71). The narrow vein of U5 *Nardus*-dominated grassland transitions southwards into a mosaic of species-poor U2 acid grassland/MG10 rush-pasture (Q72) as far as the northern half of the proposed location for T6.

24. The oblique band of M23 rush-pasture/acid grassland at Q71 transitions along a south-west to north-east axis into a narrow, more or less parallel band of M17 mire/M25 mire mosaic, this most likely arising at least in part due to local variations in slope and therefore hydrological conditions within the peat. This mosaic extends as far south as the field boundary fence-line, which is also oriented in a south-west to north-easterly direction.

25. Beyond this fence-line, the mire mosaic breaks up into a small area of MG10 and M23a rush-pastures in a mosaic with M25 mire to the east, and a more extensive area of U2 grassland/MG10 rush-pasture and M15 wet heath to the west and south (Q69). As the south-south-eastern slope supporting the above rush-pasture and wet heath mosaic levels-off to the south and west, the M15 element remains and the rush-pasture element of the mosaic is replaced with M17 mire (Q68) due to locally impeded drainage. As grazing pressure is moderate in this part of the site, scattered elements of acid grassland also punctuate the mosaic with occasional tussocks of *Molinia caerulea*. This mosaic extends to the west towards the proposed location for T14, where it transitions into a more complex mosaic of MG10 and M23a rush-

pastures and a lesser, more localised quantity of M25 mire which extends some distance to the south (Q64 & Q65).

26. The frequency of M25 mire increases to the immediate west and east, where it forms a mosaic with M15 wet heath (Q67). A localised area of well-drained, shallow peat is also present at Q66 where M25 mire exists in a mosaic with H10a *Calluna vulgaris-Erica cinerea* heath. Dwarf shrub cover in this area reaches 50% and attests to the moderate to low grazing pressure in this part of the site.

27. The southern-most part of this compartment is dominated by MG10 rush-pasture which has been subjected to some degree of agricultural improvement (Q62 & Q63). This area includes the proposed locations of the Control Building and Substation Compound, Temporary Construction Compound and Energy Storage Compound.

Compartment 5

28. The final compartment comprises the western-most 'leg' of the application area which extends to the north-north-west and includes the proposed locations for T7, T12 and T13. The compartment is described from south to north.

29. The southern limit of compartment 5 consists of a broad swathe of MG10 rush-pasture (Q39 – Q41) with minor elements of acid grassland in the form of *Festuca ovina* (to 20%) *Deschampsia flexuosa (*5%) and *Nardus stricta* (15%). A band of M23a rush-pasture/acid grassland mosaic also bisects the block of MG10 between Q39 and Q40, with a small quantity of M15 wet heath also present along the western margin of the application area between Q40 and Q41.

30. Continuing northward, reduced slope angle and varying peat depths result in a transition from MG10 rush-pasture to a mosaic of M15 wet heath, M19 blanket mire and M25 mire (Q42). Grazing pressure is moderate in this area with relatively stunted *Calluna* plants. This mosaic grades into scattered pockets of MG10- rush-pasture and a mosaic of MG10 and M23b rush-pastures to the north, these being situated where slope angle increases slightly to the east; and into an extensive area of M15 wet heath/M17 blanket mire to the north-west where the proposed location of T12 is located and the topography is gently undulating with varying peat depths (Q43 – Q46).

31. As the application boundary changes to north-north-west above T12, the M15 wet heath element of the mosaic is retained but the M17 mire element is replaced by M25 mire, most likely as a result of increased slope gradient and therefore a greater lateral flow of groundwater. Peat depth in this area is also shallow overall, precluding the presence of mire. This same habitat mosaic continues to the west (Q58), broken briefly by north-south oriented bands of very species-poor and grass-dominated MG10 rush-pasture (Q59) and a mosaic of MG10 and M23a rush-pastures with M25 mire.

32. To the west, the M15 wet heath and M25 mire gives way to deeper peat (where a limited quantity of M17 mire is present) and a north-south oriented fan of M23a rush-pasture (Q56), within which lies a small parcel of MG10 rush-pasture, and beyond

which lies an extensive mosaic of M25a mire and acid grassland (Q55) where the proposed location for T13 is also situated.

33. The final part of compartment 5 extends northwards towards the proposed location for T7; this area supports a complex mosaic of MG10 rush-pasture and a small fan of M23a rush-pasture (Q60) near the eastern boundary of the application area; a vein of M15 wet heath/M25 mire mosaic which extends as far north as T7, along the western boundary of the application site; a narrow band of M20 blanket mire/M23a rush-pasture mosaic encompassing the southern half of T7 (Q61); and a band of M15 wet heath and M17 blanket mire at the northern-most part of the application boundary. Varying peat depths and variations in slope angle account for the complex range of rush-pasture, wet heath and mire habitats encountered in the vicinity of T7.

Part 1b: NVC Descriptions - Turbine Locations

Turbine 1

1. The proposed location for Turbine 1 (T1) is towards the north-eastern corner of the application area, in an upland location of gently undulating topography to the immediate south of the Garron Plateau SAC and ASSI. The Turbine 1 centre point is located on the northern boundary of a southerly-directed fan of M23a Juncus acutiflorus-Galium saxatile rush pasture which is set within a wider expanse of very species-poor MG10 Holcus lanatus-Juncus effusus rush-pasture (Q84) which extends to the north-east and south-west of the location of T1.
2. The overwhelming dominance of the mesotrophic grass *Holcus lanatus* (95% cover) alongside two other grass species in much smaller quantities (*Agrostis canina* at 10% cover and *Anthoxanthum odoratum* at 5% cover) strongly indicate that this area has been intensively grazed as forb and bryophyte species are largely absent from this extensive area of grassland. The presence of mesotrophic grassland within an otherwise upland location also strongly indicates that at least some soil nutrient enrichment has taken place.
3. The thin soil profile in this area has also contributed to the dominance of *Holcus lanatus* which is a moisture-loving species, and also to the presence of flushed ground in the form of M23a rush-pasture to the immediate south of T1.

Turbine 2

4. The proposed location for T2 is close to the north-eastern corner of the application area, approximately 435m to the north-west of T1 and approximately 77m to the south-east of the Garron Plateau SAC and ASSI. It is similarly located in an upland location on gently undulating topography. Vegetation within the vicinity of T2 consists of a complex mosaic of M15 *Scirpus cespitosus-Erica tetralix* wet heath, M17 *Scirpus cespitosus-Eriophorum vaginatum* mire, M20 *Eriophorum vaginatum* blanket and raised mire and U2 *Deschampsia flexuosa* grassland (Q79 – Q82), with the turbine itself being located on an area of M20 mire (Q81).
5. Although soils are relatively shallow across the wider area encompassing T2, as evidenced in part by scattered but frequent basalt rock outcrops, the undulating topography supports very localised areas of slightly deeper peats situated in hollows between the low ridges where both M17 (Q80) and M20 (Q81 & Q82) blanket mire communities have developed.

Turbine 3

6. The proposed location for T3 is to the south-west of T1, situated within an extensive mosaic of MG10 *Holcus lanatus-Juncus effusus* rush-pasture (which is a south-west continuation of that at T1), M23a *Juncus acutiflorus—Galium saxatile* rush-pasture and M25 *Molinia caerulea-Potentilla erecta* mire. The turbine location is situated within an area dominated by M23a rush-pasture (Q87), on ground which slopes gradually to the south-south-east and with shallow soils which help to explain the dominance of rush-pasture at this location and within the wider area.

Turbine 4

7. The proposed location for T4 is to the west-south-west of T2, in an upland location dominated by M15 *Scirpus cespitosus-Erica tetralix* wet heath which grades into a mosaic with M17 *Scirpus cespitosus-Eriophorum vaginatum* blanket mire (incorporating scattered M3 *Eriophorum angustifolium* bog-pool communities) as peat depth increases to the north, and into a mosaic with M25 *Molinia caerulea-Potentilla erecta* mire and U2 *Deschampsia flexuosa* grassland to the north-east where peat depth also increases locally. Peat depth varies considerably in this area and accounts in part for the wide variation in habitat types over a relatively short distance. *Trichophorum germanicum* is dominant at the turbine location with occasional ericoids and a minor element of acid grassland mixed through the sward (Q75), attesting to a relatively low level of grazing pressure in this area.

Turbine 5

8. The proposed location for T5 is to the south-west of T3, on shallow soils and ground which slopes to the south-south-east. A mosaic of rush-pastures composed of M23a *Juncus acutiflorus-Galium saxatile* rush-pasture, MG10 *Holcus lanatus-Juncus effusus* rush-pasture (Q93) and, to a lesser extent, M25 *Molinia caerulea-Potentilla erecta* mire, are present and attest to much lateral groundwater movement at this location. The presence of the mesotrophic species *Trifolium repens* indicates that the area has been subjected to at least some agricultural improvement.

Turbine 6

9. The proposed location for T6 is to the south of T4, on gently undulating ground and shallow peat with M23a *Juncus acutiflorus-Galium saxatile* rush-pasture extending across the area in a north-to-south-westerly direction (Q71), this grading into a mosaic of MG10 *Holcus lanatus-Juncus effusus* rush-pasture and U2 *Deschampsia flexuosa* grassland to the north-west and into a mosaic of M17 *Scirpus cespitosus-Eriophorum vaginatum* mire and M25 *Molinia caerulea-Potentilla erecta* mire to the south-east, with M17 occurring within small, localised pockets of deeper peat to the east.

Turbine 7

10. The proposed location for T7 is along the north-western boundary of the application site, c.955m to the south-west of T4. It is located on gently undulating and sloping ground within a complex mosaic of M23a rush-pasture and M20 *Eriophorum vaginatum* mire to the west (Q61), M15 wet heath and M17 blanket mire to the north (with varying peat depths being the main distinction between the two), MG10 rush-pasture to the east and M15 wet heath and M25 mire to the south.

Turbine 8

11. The proposed location for T8 is on the southern leg of the application area, within an extensive area of MG10 rush-pasture (Q23) which grades into M15 wet heath along its extreme south-eastern margin. Peat depth in this area is shallow. The area has been subjected to at least some agricultural improvement as *Trifolium repens* is

present at low abundance but high frequency within the sward, and grazing pressure is high resulting in a lack of bryophytes and almost total dominance of mesotrophic grass species.

Turbine 9

12. The T9 location is to the south-south-west of T8 within an extensive, low-lying area of MG10 rush-pasture (Q29) on gently sloping ground. The sward is similarly dominated by graminoids with only a single forb, *Trifolium repens*, present indicating some degree of agricultural improvement. A low percentage of bryophyte cover is also present, indicating less intensive grazing pressure and a less dense sward structure.

Turbine 10

13. The proposed location of T10 is between two coniferous forestry blocks close to the southern extent of the application area, within a parcel of MG10 rush-pasture (Q34) which grades into a mosaic with M23b *Juncus effusus-Galium saxatile* rush-pasture along its northern margin. *Holcus* is dominant here alongside a range of other mesotrophic grass species including a good proportion (35%) of *Lolium perenne*; this species together with *Trifolium repens* indicates agricultural improvement in the area. Bryophytes are absent from the sward and grazing pressure is moderate to high.

Turbine 11

14. MG10 rush-pasture (Q35) dominates at the proposed site of T11, which is located to the west of coniferous forestry blocks and near the southern extent of the application area. The sward is very species-poor with a high dominance of *Holcus lanatus* (85%) and lacking any forb or bryophyte species owing to the high grazing pressure and resultant tight sward structure.

Turbine 12

15. The proposed location of T12 is on gently undulating high ground in the north-western leg of the application area, within an extensive mosaic of M15 wet heath and M17 blanket mire (Q45). Varying peat depth accounts for the mosaic, with wet heath present on shallower peat and mire on deeper peat. *Molinia caerulea* is also frequent within the sward and, together with the presence of the non-native pioneer bryophyte *Campylopus introflexus*, indicates a previous fire or similar disturbance event in the past.

Turbine 13

16. T13 is located at the western extent of the application area where the M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community is present (Q55). The local topography is gently undulating high ground on moderately deep peat and the sward is subjected to a relatively low level of grazing pressure.

Turbine 14

17. T14 is located near the centre of the application area, on ground sloping to the south-east and on marked by a complex mosaic consisting of a localised area of H10a

Calluna vulgaris-Erica cinerea dry heath, M15 wet heath and M25 mire (Q66) flanked by a mosaic of M15 wet heath and M17 blanket mire to the east, MG10 and M23a rush-pastures and M25 mire to the north and south, and an expanse of M15 wet heath and M25 mire to the west.

18. The topography in this area slopes to the south-east, with some gentle undulations creating small scale variations in local hydrology and, together with varying peat depths, results in the complex mosaic of habitat types observed. Rush-pastures dominate areas of sloping ground with mire being concentrated largely in shallow hollows; wet heath occupies some wetter slopes and shallow ridges; and a small area of dry heath present on a south-facing slope on well-drained, shallow soils.

Part 1c: NVC Quadrat Data

Quadrat no.	Date	Grid Ref
1	13th July 2021	D2608414835

Quadrat size	Surveyor	Peat depth	Site
2m x 2m	KH	0.15m	Unshinagh

Species	%age cvr	Species	%age cvr
Holcus lanatus	55	*Rhytidiadelphis squarrosus*	15
Cynosurus cristatus	30		
Agrostis capillaris	15		
Achillea millefolium	8		
Cerastium fontanum	2		

Starts as PM1 on iphone

Photo nos.	1	Species Total	6

NVC Code	Site & Vegetation Description
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure high.

Quadrat no.	Date	Grid Ref
2	13th July 2021	D2592314664

Quadrat size	Surveyor	Peat depth	Site
2m x 2m	KH	0.20m	Unshinagh

Species	%age cvr	Species	%age cvr
Cirsium palustre	8	*Deschampsia caespitosa*	3
Holcus lanatus	25	*Agrostis capillaris*	10
Cynosurus cristatus	15		
Anthoxanthum odoratum	5	*Rhytidiadelphis squarrosus*	25
Trifolium repens	15		
Nardus stricta	8		
Festuca ovina	5		
Ranunculus acris	10		
Potentilla erecta	5		
Juncus conglomeratus	10		

Photo nos.	2	Species Total	13

NVC Code	Site & Vegetation Description
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland / acid grassland mosaic. Grazing pressure moderate to heavy.

Quadrat no.	Date	Grid Ref
3	13th July 2021	D2596414531

Quadrat size	Surveyor	Peat depth	Site
2m x 2m	KH	0.55m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus acutiflorus	80	*Rhytidiadelphis squarrosus*	20
Deschampsia caespitosa	3		
Ranunculus acris	8		
Trifolium repens	10		
Agrostis canina	15		
Cardamine pratensis	1		
Holcus lanatus	3		

Photo nos.	3	Species Total	8

Quadrat no.	Date	Grid Ref
4	13th July 2021	D2600214478

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.65m	Unshinagh

Species	%age cvr	Species	%age cvr
Anthoxanthum odoratum	20	*Polytrichum commune*	30
Agrostis canina	5	*Rhytidiadelphis squarrosus*	65
Nardus stricta	5	*Sphagnum papillosum*	5
Potentilla erecta	5		
Vaccinium myrtillus	10		
Galium saxatile	15		
Juncus squarrosus	5		

Photo nos.	4	Species Total	10

NVC Code	Site & Vegetation Description
M23a *Juncus effusus/acutiflorus - Galium palustre* rush pasture, *Juncus acutiflorus* sub-community	Rush pasture. Grazing pressure moderate. Wider habitat acid grassland with pockets of rush pasture.

Quadrat no.	Date	Grid Ref
5	13th July 2021	D2608114420

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	>1.0m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus acutiflorus	70	*Pseudoscleropodium purum*	5
Juncus effusus	10	*Sphagnum papillosum*	5
Agrostis canina	15	*Rhytidiadelphis squarrosus*	55
Anthoxanthum odoratum	20	*Polytrichum commune*	25
Potentilla erecta	10		
Galium saxatile	8		
Molinia caerulea	15		
Carex nigra	2		
Luzula multiflora	3		
Photo nos.	6	Species Total	13

NVC Code	Site & Vegetation Description
U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland	Acid grassland. Grazing pressure moderate. Much greater cover of bryophytes than Q1-Q3 due to short and open sward.

Quadrat no.	Date	Grid Ref
6	13th July 2021	D2626814317

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	>1.0m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus acutiflorus	80	*Cirsium dissectum*	3
Holcus lanatus	15	*Juncus conglomeratus*	5
Anthoxanthum odoratum	5	*Carex viridula*	3
Cirsium palustre	8		
Ranunculus acris	5	*Polytrichum commune*	5
Potentilla erecta	5	*Rhytidiadelphis squarrosus*	45
Carex echinata	2		
Agrostis canina	5		
Equisetum fluviatile	8		
Trifolium repens	3		
Photo nos.	7	Species Total	15

NVC Code	Site & Vegetation Description
M23a *Juncus effusus/acutiflorus - Galium palustre* rush pasture, *Juncus acutiflorus* sub-community	Rush pasture within wider expanse of acid grassland. Grazing pressure low to moderate.

Quadrat no.	Date	Grid Ref
7	13th July 2021	D2636314179

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	>1.0m	Unshinagh

Species	%age cvr	Species	%age cvr
Nardus stricta	10	*Rhytidiadelphis squarrosus*	35
Anthoxanthum odoratum	25		
Holcus lanatus	35	Sheep dung	10
Agrostis canina	10		
Trifolium repens	5		
Cerastium fontanum	3		

NVC Code	Site & Vegetation Description
M23a *Juncus effusus/acutiflorus - Galium palustre* rush pasture, *Juncus acutiflorus* sub-community	Rush pasture. Grazing pressure low.

Quadrat no.	Date	Grid Ref
8	13th July 2021	D2653714087

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	>1.0m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus acutiflorus	75	*Succisa pratensis*	10
Dactylorhiza ericetorum	3	*Cirsium palustre*	8
Anthoxanthum odoratum	5		
Deschampsia flexuosa	5	*Aulacomnium palustre*	10
Agrostis canina	3	*Sphagnum fallax*	8
Eriophorum vaginatum	20	*Sphagnum palustre*	20

				Erica tetralix	15		
				Potentilla erecta	10	Sheep dung	5
				Carex panicea	2		
				Calluna vulgaris	15		
Photo nos.	7	Species Total	7	Photo nos.	8	Species Total	15
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Acid grassland / mesotrophic grassland mosaic. Grazing pressure moderate. Wider area a mosaic of acid grassland and Soft Rush pasture. Sward height 5cm maximum.			M23a *Juncus effusus/acutiflorus - Galium palustre* rush pasture, *Juncus acutiflorus* sub-community	Rush pasture. Grazing pressure moderate. Sward patchy. *Calluna* to 5cm height.		

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
9	13th July 2021		D2665614128		10	13th July 2021		D2678314181	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	>1.0m	Unshinagh		2m x 2m	KH	0.65m	Unshinagh	
Species	%age cvr	Species		%age cvr	Species	%age cvr	Species		%age cvr
Calluna vulgaris	55	*Sphagnum papillosum*		40	*Juncus effusus*	80	*Rhytidiadelphis squarrosus*		15
Deschampsia flexuosa	15	*Polytrichum commune*		10	*Holcus lanatus*	15			
Eriophorum vaginatum	15	*Rhytidiadelphis squarrosus*		45	*Deschampsia caespitosa*	5	Bare soil		8
Anthoxanthum odoratum	5	*Pleurozium schreberi*		8	*Anthoxanthum odoratum*	3	Sheep dung		3
Carex nigra	5				*Trifolium repens*	10			
Molinia caerulea	20								
Luzula multiflora	5								
Potentilla erecta	8								
Galium saxatile	3								
Holcus lanatus	15								
Photo nos.	9	Species Total		14	Photo nos.	10	Species Total		6
NVC Code	Site & Vegetation Description				NVC Code	Site & Vegetation Description			
M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire/M25 *Molinia caerulea-Potentilla erecta* mire	Fine-scaled acid grassland/blanket mire mosaic with scattered stands of *Juncus effusus* . Sward includes *Calluna* to 5cm height. Vegetation over-grazed.				M23b *Juncus effusus/acutiflorus- Galium saxatile* rush pasture, *Juncus effusus* sub-community	Rush pasture in mosaic with mesotrophic grassland. Grazing pressure in grassland element moderate to heavy, light within rush pasture indicating preference for graminoids over rushes.			

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
11	13th July 2021		D2685714226		12	13th July 2021		D2693414254	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.30m	Unshinagh		2m x 2m	KH	0.10m	Unshinagh	
Species	%age cvr	Species		%age cvr	Species	%age cvr	Species		%age cvr
Holcus lanatus	65				*Juncus effusus*	10	*Carex nigra*		2

Lolium perenne	10			*Juncus acutiflorus*	35	*Carex viridula*	3
Trifolium repens	45			*Holcus lanatus*	20	*Juncus articulatus*	10
Agrostis canina	5			*Anthoxanthum odoratum*	10	*Ranunculus repens*	5
Cynosurus cristatus	15			*Ranunculus flammula*	25	*Cardamine pratense*	2
Ranunculus acris	8			*Jacobaea palustris*	30	*Agrostis canina*	2
				Trifolium repens	20	*Alopecurus geniculatus*	2
				Carex echinata	5		
				Cynosurus cristatus	3	*Brachythecium rutabulum*	10
				Juncus conglomeratus	8		
Photo nos.	11	Species Total	6	Photo nos.	12	Species Total	18

NVC Code	Site & Vegetation Description
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland; in wider area exists within mosaic with scattered stands of *Juncus effusus* . Grazing pressure moderate to high. Sward tight, hence no bryophytes.

NVC Code	Site & Vegetation Description
M23a *Juncus effusus/acutiflorus* - rush pasture, *Juncus acutiflorus* sub-community	Rush pasture with abundance of *J. palustris* and *R. flammula* . Grazing pressure very low to absent. Sward tall and dense, hence lack of bryophytes.

Quadrat no.	Date	Grid Ref
13	13th July 2021	D2583514657

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.55m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus acutiflorus	75		
Ranunculus acris	8		
Trifolium repens	35		
Carex echinata	3		
Anthoxanthum odoratum	5		
Holcus lanatus	8		
Cynosurus cristatus	3		
Deschampsia caespitosa	2		
Galium palustre	3		
Agrostis canina	2		
Photo nos.	13	Species Total	10

NVC Code	Site & Vegetation Description
M23a *Juncus effusus/acutiflorus* - rush pasture, *Juncus acutiflorus* sub-community	Rush pasture. Grazing pressure low. Sward tall and dense, hence lack of bryophytes.

Quadrat no.	Date	Grid Ref

Quadrat no.	Date	Grid Ref
14	13th July 2021	D2574314644

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.40m	Unshinagh

Species	%age cvr	Species	%age cvr
Agrostis canina	35	*Rhytidiadelphis squarrosus*	35
Anthoxanthum odoratum	15	*Hypnum jutlandicum*	15
Potentilla erecta	10	*Hylocomium splendens*	20
Galium saxatile	10		
Trichophorum germanicum	1		
Carex nigra	2		
Carex echinata	5		
Photo nos.	14	Species Total	10

NVC Code	Site & Vegetation Description
U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland	Acid grassland. Grazing pressure low to moderate. Sward open and patchy.

Quadrat no.	Date	Grid Ref

Quadrat no.	Date	Grid Ref

15		13th July 2021		D2566014626		16		13th July 2021		D2540814646	
Quadrat size	Surveyor	Peat Depth		Site		Quadrat size	Surveyor	Peat Depth		Site	
2m x 2m	KH		>1.0m	Unshinagh		2m x 2m	KH		0.15m	Unshinagh	
Species		%age cvr	Species		%age cvr	Species		%age cvr	Species		%age cvr
Calluna vulgaris		20	*Polytrichum commune*		35	*Holcus lanatus*		35	*Rhytidiadelphis squarrosus*		20
Trichophorum germanicum		45	*Sphagnum papillosum*		8	*Anthoxanthum odoratum*		20	*Hylocomium splendens*		15
Erica tetralix		5	*Sphagnum capillifolium*		15	*Agrostis canina*		30			
Eriophorum vaginatum		8	*Rhytidiadelphis squarrosus*		20	*Galium saxatile*		5	Sheep dung		10
Narthecium ossifragum		5	*Hypnum jutlandicum*		25	*Nardus stricta*		3			
Eriophorum angustifolium		3									
Dryopteris dilatata		5									
Anthoxanthum odoratum		5									
Photo nos.		15	Species Total		13	Photo nos.		16	Species Total		7
NVC Code			Blanket mire. Grazing pressure			NVC Code		Site & Vegetation Description			
M17 *Trichophorum cespitosum-*			low.			MG10 *Holcus lanatus-Juncus*		Mesotrophic grassland with minor element of acid			
Eriophorum vaginatum mire						*effusus* rush-pasture		grassland. Grazing pressure moderate.			

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
17	13th July 2021		D2530514616		18	13th July 2021		D2524814640	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.30m	Unshinagh		2m x 2m	KH	0.35m	Unshinagh	
Species	%age cvr	Species		%age cvr	Species		%age cvr	Species	%age cvr
Holcus lanatus	45	*Rhytidiadelphis squarrosus*		45	*Holcus lanatus*		60	*Rhytidiadelphis squarrosus*	25
Anthoxanthum odoratum	15	*Hylocomium splendens*		15	*Anthoxanthum odoratum*		10	*Pseudoscleropodium purum*	15
Agrostis canina	10				*Agrostis canina*		8		
Festuca ovina	3				*Cirsium palustre*		5		
Nardus stricta	5				*Nardus stricta*		15		
Cerastium fontanum	3				*Cirsium dissectum*		5		
					Final quad on iphone at W boundary before switching to ipad				
Photo nos.	17	Species Total		8	Photo nos.		18	Species Total	8
NVC Code	Site & Vegetation Description				NVC Code		Site & Vegetation Description		

MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland with minor element of acid grassland. Grazing pressure moderate to high.

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
19	4th August 2021		D2514414511		20	4th August 2021		D2506814364	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.10m	Unshinagh		2m x 2m	KH	0.15m	Unshinagh	
Species	%age cvr	Species	%age cvr		Species	%age cvr	Species	%age cvr	
Nardus stricta	60	*Thuidium tamariscinum*	20		*Anthoxanthum odoratum*	25	*Rhytidiadelphis squarrosus*	45	
Anthoxanthum odoratum	15	*Rhytidiadelphis squarrosus*	35		*Holcus lanatus*	20	*Brachythecium rutabulum*	15	
Deschampsia caespitosa	10	*Hypnum jutlandicum*	15		*Nardus stricta*	40			
Agrostis capillaris	8	*Polytrichum commune*	5		*Agrostis capillaris*	10			
Potentilla erecta	10								
Carex panicea	3								
Vaccinium myrtillus	5								
Galium saxatile	8								
Luzula multiflora	2								
Photo nos.	19	Species Total	13		Photo nos.	20	Species Total	6	

NVC Code	Site & Vegetation Description
U5 *Nardus stricta-Galium saxatile* grassland	Acid grassland. Grazing pressure moderate.

NVC Code	Site & Vegetation Description
U5 *Nardus stricta-Galium saxatile* grassland	Acid grassland. Grazing pressure high. Sward closely grazed, to 5cm height, open with well developed bryophyte layer.

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
21	4th August 2021		D2499214178		22	4th August 2021		D2503614050	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.30m	Unshinagh		2m x 2m	KH	0.35m	Unshinagh	
Species	%age cvr	Species	%age cvr		Species	%age cvr	Species	%age cvr	
Anthoxanthum odoratum	15				*Anthoxanthum odoratum*	15	*Agrostis stolonifera*	20	
Agrostis capillaris	15				*Juncus effusus*	15	*Nardus stricta*	15	
Holcus lanatus	20				*Holcus lanatus*	25	*Alopecurus geniculatus*	3	
Nardus stricta	45				*Agrostis capillaris*	8			
Trifolium repens	10				*Luzula multiflora*	1			
Alopecurus geniculatus	3				*Carex echinata*	5			
Deschampsia caespitosa	8				*Lolium perenne*	2			

				Cirsium dissectum	3		
Sheep dung	10			*Molinia caerulea*	2		
				Deschampsia caespitosa	5		
Photo nos.	21	Species Total	7	Photo nos.	22	Species Total	13
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
U5 *Nardus stricta-Galium saxatile* grassland	Acid grassland. Grazing pressure very high, hence lack of bryophytes. Sward to 7cm height.			MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland with minor element of acid grassland. Grazing pressure very high, hence lack of bryophytes. Grass sward to 5cm height (rushes to 25cm height).		

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
23	4th August 2021		D2509013967		24	4th August 2021		D2508313838	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.30m	Unshinagh		2m x 2m	KH	0.35m	Unshinagh	
Species	%age cvr	Species	%age cvr		Species	%age cvr	Species	%age cvr	
Holcus lanatus	65				*Anthoxanthum odoratum*	15			
Trifolium repens	8				*Holcus lanatus*	60			
Agrostis capillaris	15				*Agrostis capillaris*	25			
Agrostis stolonifera	10				*Deschampsia caespitosa*	10			
Deschampsia caespitosa	10				*Lolium perenne*	5			

Photo nos.	23	Species Total	5	Photo nos.	24	Species Total	5
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure high, hence sward tight and lacking bryophytes.			MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure high, hence sward tight and lacking bryophytes.		

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
25	4th August 2021		D2503513776		26	4th August 2021		D2495813725	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.25m	Unshinagh		2m x 2m	KH	0.55m	Unshinagh	
Species	%age cvr	Species	%age cvr		Species	%age cvr	Species	%age cvr	
Juncus effusus	25				*Molinia caerulea*	30	*Polytrichum commune*	8	
Cirsium palustre	15				*Eriophorum angustifolium*	15	*Aulacomnium palustre*	10	

Anthoxanthum odoratum	20			*Erica tetralix*	10	*Sphagnum capillifolium*	20
Holcus lanatus	35			*Deschampsia caespitosa*	15	*Rhytidiadelphis loreus*	20
Agrostis capillaris	20			*Calluna vulgaris*	30	*Sphagnum fallax*	10
Deschampsia caespitosa	10			*Polygala serpyllifolia*	3	*Rhytidiadelphis squarrosus*	45
				Eriophorum vaginatum	35		
				Potentilla erecta	3		

Photo nos.	25	Species Total	6	Photo nos.	26	Species Total	14
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland/rush pasture mosaic. Grazing pressure moderate. Sward dense, hence lack of bryophytes.			M19a *Calluna vulgaris-Eriophorum vaginatum* blanket mire, *Erica tetralix* subcommunity/M25 *Molinia caerulea-Potentilla erecta* mire	Blanket mire/acid grassland mosaic. Grazing pressure moderate. *Calluna* to 10cm height. *E. vaginatum* tussocks small. This habitat small and limited in extent within wider area of acid/mesotrophic grassland.		

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
27	4th August 2021	D2488213609	28	4th August 2021	D2486213531

Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.30m	Unshinagh	2m x 2m	KH	0.30m	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Holcus lanatus	70			*Anthoxanthum odoratum*	15	*Sphagnum papillosum*	10
Anthoxanthum odoratum	15			*Molinia caerulea*	10		
Agrostis capillaris	15			*Erica tetralix*	3	Cattle dung	10
Deschampsia caespitosa	5			*Narthecium ossifragum*	8	Bare ground	5
Nardus stricta	15			*Carex panicea*	10		
				Carex echinata	3		
Sheep dung	5			*Juncus bulbosus*	3		
				Trichophorum germanicum	20		
				Eriophorum angustifolium	8		
				Eriophorum vaginatum	5		

Photo nos.	27	Species Total	5	Photo nos.	28	Species Total	11
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland with minor element of acid grassland. Grazing pressure moderate.			M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community	Acid grassland with elements of wet heath. Poaching evident with occasional bare peat. Grazing pressure high within the general vicinity. Grazing by cattle. Quadrat situated in low-lying hollow.		

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
29	4th August 2021	D2481813485	30	4th August 2021	D2476413381

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.40m	Unshinagh

Species	%age cvr	Species	%age cvr
Anthoxanthum odoratum	30	*Rhytidiadelphis squarrosus*	20
Holcus lanatus	40	*Pseudoscleropodium purum*	5
Deschampsia caespitosa	10		
Trifolium repens	30		
Agrostis capillaris	10		

Photo nos.	29	Species Total	7

NVC Code	Site & Vegetation Description
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure moderate. Cattle-grazed.

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.35m	Unshinagh

Species	%age cvr	Species	%age cvr
Anthoxanthum odoratum	60	*Rhytidiadelphis squarrosus*	70
Agrostis capillaris	45		
Deschampsia caespitosa	5		
Molinia caerulea	3		
Carex nigra	2		
Holcus lanatus	20		

Photo nos.	30	Species Total	7

NVC Code	Site & Vegetation Description
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure moderate. Cattle-grazed.

Quadrat no.	Date	Grid Ref
31	4th August 2021	D2486213293

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.10m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus effusus	15		
Anthoxanthum odoratum	25		
Holcus lanatus	60		
Agrostis capillaris	20		
Deschampsia caespitosa	10		
Trifolium repens	5		

Photo nos.	31	Species Total	6

NVC Code	Site & Vegetation Description
MG10 *Holcus lanatus-Juncus*	Mesotrophic grassland with scattered tussocks of

Quadrat no.	Date	Grid Ref
32	4th August 2021	D2503113056

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.70m	Unshinagh

Species	%age cvr	Species	%age cvr
Eriophorum angustifolium	5	*Sphagnum papillosum*	50
Eriophorum vaginatum	30	*Sphagnum capillifolium*	25
Juncus squarrosus	10	*Hypnum jutlandicum*	10
Molinia caerulea	15	*Sphagnum fallax*	10
Erica tetralix	5	*Polytrichum commune*	5
Potentilla erecta	3		

Photo nos.	32	Species Total	11

NVC Code	Site & Vegetation Description
M20 *Eriophorum vaginatum*	Wet, low-lying hollow within rush pasture. Grazing

effusus rush-pasture	*Juncus effusus*. Grazing pressure high. Cattle-grazed. Sward tight, hence lack of bryophytes.	blanket and raised mire	pressure moderate. Sheep-grazed.

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
33	4th August 2021	D2508313003	34	4th August 2021	D2516712964
Quadrat size	Surveyor / Peat Depth	Site	Quadrat size	Surveyor / Peat Depth	Site
2m x 2m	KH / 0.30m	Unshinagh	2m x 2m	KH / 0.20m	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Anthoxanthum odoratum	3			*Holcus lanatus*	55		
Lolium perenne	5			*Lolium perenne*	35		
Holcus lanatus	95			*Cynosurus cristatus*	5		
Trifolium repens	10			*Deschampsia caespitosa*	8		
Deschampsia caespitosa	10			*Cerastium fontanum*	3		
Cynosurus cristatus	3			*Trifolium repens*	15		
				Anthoxanthum odoratum	2		

Photo nos.	33	Species Total	6	Photo nos.	34	Species Total	7
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Sheep-grazed, grazing pressure moderate. Sward tight, hence lack of bryophytes.			MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Sheep-grazed, grazing pressure moderate to high. Sward tight, hence lack of bryophytes.		

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
35	4th August 2021	D2453312866	36	4th August 2021	D2456912966
Quadrat size	Surveyor / Peat Depth	Site	Quadrat size	Surveyor / Peat Depth	Site
2m x 2m	KH / 0.30cm	Unshinagh	2m x 2m	KH / 0.35cm	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Anthoxanthum odoratum	10			*Juncus effusus*	10		
Holcus lanatus	85			*Holcus lanatus*	95		
Deschampsia caespitosa	15			*Deschampsia caespitosa*	8		
				Anthoxanthum odoratum	3		

Photo nos.	35	Species Total	3
NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Sheep-grazed, grazing pressure moderate to high. Sward tight, hence lack of bryophytes.		

Quadrat no.	Date	Grid Ref
37	4th August 2021	D2463513064

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.30m	Unshinagh

Species	%age cvr	Species	%age cvr
Holcus lanatus	80		
Anthoxanthum odoratum	15	Cow dung	8
Ranunculus repens	8		
Deschampsia caespitosa	5		
Lolium perenne	15		

Photo nos.	36	Species Total	4
NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland with occasional *Juncus effusus* tussocks within quadrat and wider area. Grazing pressure moderate to high. Sward tight, hence lack of bryophytes.		

Quadrat no.	Date	Grid Ref
38	4th August 2021	D2468213230

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.25m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus effusus	60	*Rhytidiadelphis squarrosus*	15
Holcus lanatus	35		
Juncus conglomeratus	3		
Anthoxanthum odoratum	10		
Trifolium repens	3		
Ranunculus repens	8		

PM26 on ipad; then switches back to iphone

Photo nos.	37	Species Total	5
NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure moderate to high. Sward tight, hence lack of bryophytes.		

Quadrat no.	Date	Grid Ref
39	12th August 2021	D2523214759

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.15m	Unshinagh

Species	%age cvr	Species	%age cvr
Nardus stricta	15	*Rhytidiadelphis squarrosus*	30
Holcus lanatus	50		
Cynosurus cristatus	20	Sheep dung	8

Photo nos.	38	Species Total	7
NVC Code	Site & Vegetation Description		
M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus effusus* sub-community/MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland/rush pasture mosaic. Sward tight, hence low bryophyte cover, and patchy - short where dominated by graminoids (to 8cm), taller where rushes dominate (to 35cm). Grazing pressure moderate.		

Quadrat no.	Date	Grid Ref
40	12th August 2021	D2520214957

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.10m	Unshinagh

Species	%age cvr	Species	%age cvr
Holcus lanatus	55	*Rhytidiadelphis squarrosus*	40
Agrostis capillaris	10		
Anthoxanthum odoratum	25	Sheep dung	8

Agrostis capillaris	5	Fungi	5	*Deschampsia caespitosa*	8
Cardamine pratense	10			*Festuca ovina*	15
Cirsium dissectum	8				
Festuca ovina	20				

PM31 on iphone

Photo nos.	39	Species Total	8	Photo nos.	40	Species Total	6
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland with minor element of acid grassland. Grazing pressure moderate. Sward tight and dominated by grasses.			MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure moderate. Sward tight and dominated by grasses.		

Quadrat no.	Date		Grid Ref	Quadrat no.	Date		Grid Ref	
41	12th August 2021		D2517615084	42	12th August 2021		D2515015184	
Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.20m	Unshinagh	2m x 2m	KH	0.50m	Unshinagh	
Species	%age cvr	Species	%age cvr	Species	%age cvr	Species		%age cvr
Potentilla erecta	15	*Hylocomium splendens*	15	*Calluna vulgaris*	15	*Polytrichum commune*		10
Anthoxanthum odoratum	20	*Hypnum jutlandicum*	8	*Vaccinium myrtillus*	30	*Sphagnum subnitens*		15
Nardus stricta	15	*Rhytidiadelphis squarrosus*	35	*Deschampsia caespitosa*	20	*Sphagnum fallax*		5
Holcus lanatus	20			*Molinia caerulea*	20	*Rhytidiadelphis loreus*		40
Agrostis capillaris	5	Rock	10	*Potentilla erecta*	15	*Plagiomnium undulatum*		3
Festuca ovina	8			*Eriophorum vaginatum*	35			
Carex panicea	3			*Luzula multiflora*	3	Sheep dung		5
Danthonia procumbens	1			*Galium saxatile*	2			
Deschampsia flexuosa	5							

Photo nos.	41	Species Total	12	Photo nos.	42	Species Total	13
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland/acid grassland mosaic. Sward patchy on thin soils.			M19a *Calluna vulgaris-Eriophorum vaginatum* blanket mire, *Erica tetralix* subcommunity/M25 *Molinia caerulea-Potentilla erecta* mire	Acid grassland/blanket mire mosaic. Grazing pressure moderate. *Calluna* to 10cm height. Sward patchy.		

Quadrat no.	Date		Grid Ref	Quadrat no.	Date		Grid Ref
43	12th August 2021		D2510015327	44	12th August 2021		D2503215373
Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site

2m x 2m	KH	0.55m	Unshinagh

Species	%age cvr	Species	%age cvr
Erica tetralix	15	*Sphagnum capillifolium*	15
Trichophorum germanicum	65	*Rhytidiadelphis loreus*	15
Molinia caerulea	20	*Hypnum jutlandicum*	10
Juncus squarrosus	10	*Rhytidiadelphis squarrosus*	30
Calluna vulgaris	5		
Potentilla erecta	15		
Carex panicea	3		
Polygala serpyllifolia	5		

Photo nos.	43	Species Total	12

NVC Code	Site & Vegetation Description
M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire	Blanket mire. Grazing pressure moderate. *Calluna* to 10cm height. Sward patchy. *S. capillifolium* hummocks occasional. *Trichophorum dominant* in wider area.

2m x 2m	KH	0.60m	Unshinagh

Species	%age cvr	Species	%age cvr
Calluna vulgaris	30	*Racomitrium languinosum*	15
Erica tetralix	20	*Sphagnum compactum*	3
Trichophorum germanicum	30		
Molinia caerulea	25	Sheep dung	3
Potentilla erecta	8		
Eriophorum angustifolium	10		
Polygala serpyllifolia	3		
Carex echinata	3		
Narthecium ossifragum	8		

Photo nos.	44	Species Total	11

NVC Code	Site & Vegetation Description
M17 *Trichophorum cespitosum-Eriophorum vaginatum* mire, *Cladonia* sub-community	Blanket mire dominated by *Trichophorum* in wider area. Grazing pressure moderate. *Calluna* to 10cm height.

Quadrat no.	Date	Grid Ref
45	12th August 2021	D2496615292

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.50m	Unshinagh

Species	%age cvr	Species	%age cvr
Calluna vulgaris	30	*Sphagnum capillifolium*	8
Erica tetralix	15	*Hypnum jutlandicum*	45
Juncus squarrosus	10	*Campylopus introflexus*	5
Trichophorum germanicum	50		
Potentilla erecta	8		
Molinia caerulea	40		
Carex panicea	1		
Carex echinata	3		

Photo nos.	45	Species Total	11

NVC Code	Site & Vegetation Description
M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket	Blanket mire/acid grassland mosaic. Grazing pressure moderate. *Calluna* to 20cm height. Sward patchy.

Quadrat no.	Date	Grid Ref
46	12th August 2021	D2485915222

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	>1.0m	Unshinagh

Species	%age cvr	Species	%age cvr
Calluna vulgaris	60	*Sphagnum capillifolium*	55
Erica tetralix	10	*Sphagnum papillosum*	15
Trichophorum germanicum	35	*Racomitrium languinosum*	8
Eriophorum vaginatum	15	*Hypnum jutlandicum*	10
Narthecium ossifragum	15		
Eriophorum angustifolium	8		

Photo nos.	46	Species Total	10

NVC Code	Site & Vegetation Description
M17 *Trichophorum cespitosum-Eriophorum vaginatum* mire	Blanket mire. Grazing pressure low to moderate. *Calluna* to 30cm height, more dominant than in previous quadrats.

mire

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
47	12th August 2021	D2477115135	48	12th August 2021	D2469115085
Quadrat size	Surveyor / Peat Depth	Site	Quadrat size	Surveyor / Peat Depth	Site
2m x 2m	KH / 0.60m	Unshinagh	2m x 2m	KH / 0.80m	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Calluna vulgaris	5	*Hypnum jutlandicum*	35	*Eriophorum vaginatum*	65	*Sphagnum capillifolium*	25
Erica tetralix	8	*Thuidium tamariscinum*	8	*Empetrum nigrum*	10	*Campylopus introflexus*	3
Trichophorum germanicum	65	*Sphagnum capillifolium*	5	*Deschampsia flexuosa*	35	*Sphagnum palustre*	5
Molinia caerulea	55			*Vaccinium myrtillus*	20	*Polytrichum commune*	10
Potentilla erecta	8			*Potentilla erecta*	20		
Empetrum nigrum	10			*Juncus squarrosus*	10		
Carex panicea	2			*Molinia caerulea*	10		
Deschampsia caespitosa	5			*Polygala serpyllifolia*	3		

Photo nos.	47	Species Total	11	Photo nos.	48	Species Total	12
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
M17 *Trichophorum cespitosum-Eriophorum vaginatum* mire	Blanket mire/acid grassland mosaic. Grazing pressure low to moderate. *Calluna* sparse, to 15cm height.			M19a *Calluna vulgaris-Eriophorum vaginatum* blanket mire/M25 *Molinia caerulea-Potentilla erecta* mire	Blanket mire/acid grassland mosaic. Grazing pressure low to moderate. *Empetrum* and *V. myrtillus* growing from *Eriophorum* tussocks.		

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
49	12th August 2021	D2453515041	50	12th August 2021	D2441515113
Quadrat size	Surveyor / Peat Depth	Site	Quadrat size	Surveyor / Peat Depth	Site
2m x 2m	KH / 0.60m	Unshinagh	2m x 2m	KH / 0.60m	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Eriophorum vaginatum	60	*Sphagnum papillosum*	15	*Molinia caerulea*	65	*Rhytidiadelphis loreus*	10
Deschampsia flexuosa	8			*Erica tetralix*	8	*Hypnum jutlandicum*	20
Molinia caerulea	15			*Vaccinium myrtillus*	10	*Rhytidiadelphis squarrosus*	8
Vaccinium myrtillus	25			*Calluna vulgaris*	8	*Sphagnum capillifolium*	5
Empetrum nigrum	30			*Empetrum nigrum*	55	*Polytrichum commune*	10
Potentilla erecta	15			*Juncus squarrosus*	8		
Erica tetralix	10			*Potentilla erecta*	8		
Vaccinium oxycoccos	8						
Eriophorum angustifolium	5						

Photo nos.	49	Species Total	10
NVC Code	Site & Vegetation Description		
M20 *Eriophorum vaginatum* blanket and raised mire	Blanket mire. Grazing pressure low to moderate. Sward patchy, dominated by *E. vaginatum* tussocks with minor acid grassland element.		

Quadrat no.	Date	Grid Ref	
51	12th August 2021	D2429814959	
Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.60m	Unshinagh

Species	%age cvr	Species	%age cvr
Calluna vulgaris	5	*Sphagnum capillifolium*	8
Erica tetralix	8	*Hypnum jutlandicum*	20
Molinia caerulea	70		
Trichophorum germanicum	35		
Juncus squarrosus	15		
Carex panicea	3		
Potentilla erecta	8		
Polygala serpyllifolia	3		
Deschampsia flexuosa	5		

Photo nos.	50	Species Total	12
NVC Code	Site & Vegetation Description		
M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community	Wet heath/acid grassland mosaic. Sward patchy. Grazing pressure low to moderate.		

Quadrat no.	Date	Grid Ref	
52	12th August 2021	D2422414862	
Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.5m	Unshinagh

Species	%age cvr	Species	%age cvr
Calluna vulgaris	35	*Sphagnum capillifolium*	25
Erica tetralix	5	*Cladonia portentosa*	5
Trichophorum germanicum	45	*Racomitrium languinosum*	8
Potentilla erecta	5		
Molinia caerulea	40		
Narthecium ossifragum	5		
Deschampsioa flexuosa	3		
Eriophorum angustifolium	5		
Eriophorum vaginatum	20		

Photo nos.	51	Species Total	11
NVC Code	Site & Vegetation Description		
M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community	Blanket mire/acid grassland mosaic. Grazing pressure low to moderate. *Calluna* to 30cm height and sparse.		

Quadrat no.	Date	Grid Ref	
53	12th August 2021	D2430715102	
Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	1.0m	Unshinagh

Species	%age cvr	Species	%age cvr
Calluna vulgaris	15	*Sphagnum capillifolium*	15
Erica tetralix	3	*Sphagnum papillosum*	3
Trichophorum germanicum	25		
Molinia caerulea	60	Bare peat	8

Photo nos.	52	Species Total	12
NVC Code	Site & Vegetation Description		
M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire	Blanket mire. Sward patchy. Grazing pressure low to moderate. *Calluna* to 25cm height.		

Quadrat no.	Date	Grid Ref	
54	12th August 2021	D2432415191	
Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	>1.0m	Unshinagh

Species	%age cvr	Species	%age cvr
Erica tetralix	15	*Sphagnum capillifolium*	30
Juncus squarrosus	15		
Eriophorum angustifolium	55	Bare peat	15
Calluna vulgaris	5		

Deschampsia flexuosa	3			*Empetrum nigrum*	8		
Eriophorum angustifolium	20			*Deschampsia flexuosa*	5		
Narthecium ossifragum	8			*Vaccinium myrtillus*	5		
Erica cinerea	5			*Potentilla erecta*	10		
				Juncus acutiflorus	3		
				Trichophorum germanicum	20		
Photo nos.	53	Species Total	10	Photo nos.	54	Species Total	11

NVC Code	Site & Vegetation Description	NVC Code	Site & Vegetation Description
M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community	Blanket mire/acid grassland mosaic. *Molinia* dominant within the wider area with only occasional *Calluna* , to 20cm height. Grazing pressure low. Sward patchy. Bog pool margin (bare peat) within quadrat.	M3 *Eriophorum angustifolium* bog pool community, species-rich due to re-establishment of mire species after disturbance.	Blanket mire. *Molinia* dominant within the wider area with only occasional *Calluna* , to 25cm height. Grazing pressure low. Sward patchy.

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
55	12th August 2021	D2434815323	56	12th August 2021	D2444215487

Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.30m	Unshinagh	2m x 2m	KH	>1.0m	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Erica tetralix	20	*Carex echinata*	1	*Juncus acutiflorus*	65	*Sphagnum papillosum*	10
Molinia caerulea	60			*Molinia caerulea*	25		
Potentilla erecta	10	*Sphagnum capillifolium*	20	*Erica tetralix*	15		
Carex viridula	1			*Potentilla erecta*	15		
Luzula multiflora	1	Sheep dung	8	*Deschampsia flexuosa*	10		
Deschampsia flexuosa	3			*Deschampsia caespitosa*	2		
Eriophorum vaginatum	20			*Juncus squarrosus*	10		
Juncus squarrosus	10			*Empetrum nigrum*	8		
Trichophorum germanicum	15			*Festuca ovina*	3		
Viola palustris	3			*Anthoxanthum odoratum*	1		
Photo nos.	55	Species Total	12	Photo nos.	56	Species Total	11

NVC Code	Site & Vegetation Description	NVC Code	Site & Vegetation Description
M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community	Wet heath/acid grassland mosaic. *Molinia* dominant within the wider area with only occasional *Calluna* , to 25cm height. Grazing pressure low. Sward patchy.	M23a *Juncus effusus/acutiflorus* - rush pasture, *Juncus acutiflorus* sub-community	Rush pasture within wider blanket mire/acid grassland mosaic. Grazing pressure low.

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
57	12th August 2021	D2547815528	58	12th August 2021	D2471015422

Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.30m	Unshinagh	2m x 2m	KH	0.45m	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Juncus acutiflorus	55	*Sphagnum cuspidatum*	8	*Calluna vulgaris*	15	*Rhytidiadelphis squarrosus*	15
Erica tetralix	5			*Molinia caerulea*	70	*Hypnum jutlandicum*	8
Carex viridula	30			*Juncus acutiflorus*	5	*Cladonia portentosa*	5
Potentilla erecta	10			*Erica tetralix*	15		
Viola palustris	5			*Deschampsia flexuosa*	8	Bare peat	5
Polygala serpyllifolia	3			*Potentilla erecta*	8		
Carex panicea	10			*Polygala serpyllifolia*	1		
Ranunculus flammula	5			*Narthecium ossifragum*	15		

Photo nos.	57	Species Total	9	Photo nos.	58	Species Total	11
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
M23a *Juncus effusus/acutiflorus* - rush pasture, *Juncus acutiflorus* sub-community	Wide swathe of rush pasture within wider acid grassland/blanket mire mosaic. Grazing pressure moderate.			M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community	Wet heath/acid grassland mosaic with minor element of rush pasture. Grazing pressure moderate. Sward patchy. *Calluna* to 10cm height.		

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
59	12th August 2021	D2479315472	60	12th August 2021	D2494415586
Quadrat size	Surveyor	Peat Depth / Site	Quadrat size	Surveyor	Peat Depth / Site
2m x 2m	KH	0.35m Unshinagh	2m x 2m	KH	0.40m Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Holcus lanatus	90	*Rhytidiadelphis squarrosus*	8	*Juncus acutiflorus*	70	*Sphagnum papillosum*	40
Agrostis capillaris	20			*Taraxacum officinale agg.*	3	*Calliergonella cuspidatum*	15
Anthoxanthum odoratum	5	Sheep dung	3	*Leontodon autumnalis*	5		
				Potentilla erecta	8		
				Holcus lanatus	5		
				Viola palustris	10		
				Hydrocotyle vulgaris	3		
				Carex panicea	30		
				Cirsium dissectum	3		

Photo nos.	59	Species Total	4	Photo nos.	60	Species Total	11
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Sward open and patchy. Grazing pressure low to moderate. Sward tight, hence only sparse bryophyte layer.			M23a *Juncus effusus/acutiflorus* - rush pasture, *Juncus acutiflorus* sub-community	Band of rush pasture. Sward patchy and open. Grazing pressure moderate.		

Quadrat no.	Date	Grid Ref
61	16th August 2021	D2486915697

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.60m	Unshinagh

Species	%age cvr	Species	%age cvr
Galium saxatile	3	*Molinia caerulea*	5
Carex flacca	15	*Polygala serpyllifolia*	2
Juncus acutiflorus	20	*Eriophorum vaginatum*	25
Potentilla erecta	15		
Luzula multiflora	1	*Rhytidiadelphis squarrosus*	20
Juncus squarrosus	15	*Thuidium tamariscinum*	8
Carex echinata	3		
Deschampsia flexuosa	5	Sheep dung	3
Trichophorum germanicum	10	Bare rock	8
Nardus stricta	3		
Photo nos.	61	Species Total	15

NVC Code

M23a *Juncus acutiflorus-Galium saxatile* rush-pasture, *J. acutiflorus* sub-community/M20 *Eriophorum vaginatum* blanket mire

Site & Vegetation Description

Rush pasture with element of blanket mire. Grazing pressure moderate. Sward patchy and open.

Quadrat no.	Date	Grid Ref
62	16th August 2021	D2559714811

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.05m	Unshinagh

Species	%age cvr	Species	%age cvr
Agrostis capillaris	15	*Rhytidiadelphis squarrosus*	35
Holcus lanatus	90	*Hylocomium splendens*	15
Festuca ovina	10		
Nardus stricta	8	Sheep dung	10
Photo nos.	62	Species Total	6

NVC Code

MG10 *Holcus lanatus-Juncus effusus* rush-pasture

Site & Vegetation Description

Mesotrophic grassland. Grazing pressure high. Sward short with only occasional, low bryophyte hummocks. *Nardus* scattered thinly in wider area.

Quadrat no.	Date	Grid Ref
63	16th August 2021	D2552115031

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.10m	Unshinagh

Species	%age cvr	Species	%age cvr
Holcus lanatus	85	Sheep dung	3
Agrostis capillaris	10		
Nardus stricta	15		
Festuca ovina	8		

Quadrat no.	Date	Grid Ref
64	16th August 2021	D2553015105

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.20m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus acutiflorus	35	*Triglochin palustre*	2
Holcus lanatus	30	*Carex echinata*	1
Potentilla erecta	15	*Festuca ovina*	10
Carex nigra	8		
Cynosurus cristatus	10	*Rhytidiadelphis squarrosus*	45
Anthoxanthum odoratum	5	*Calliergonella cuspidatum*	10
Anagallis tenella	3	*Hylocomium splendens*	8
Carex panicea	25	*Aulacomnium palustre*	5
Cardamine pratense	3	*Sphagnum palustre*	20
Trichophorum germanicum	5	*Sphagnum capillifolium*	8

Photo nos.	63	Species Total	4
NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure high. Sward short with Nardus scattered thinly in wider area. *Cirsium vulgare* stands also occasional in wider area.		

Quadrat no.	Date	Grid Ref
65	16th August 2021	D2546615226

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.35m	Unshinagh

Species	%age cvr	Species	%age cvr
Juncus acutiflorus	75	*Sphagnum palustre*	10
Potentilla erecta	15	*Rhytidiadelphis squarrosus*	35
Cirsium palustre	8	*Pseudoscleropodium purum*	8
Anthoxanthum odoratum	8	*Hylocomium splendens*	10
Holcus lanatus	20		
Agrostis canina	10	Sheep dung	5
Cirsium dissectum	2		
Carex flacca	10		

Photo nos.	64	Species Total	19
NVC Code	Site & Vegetation Description		
M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *J. acutiflorus* sub-community/MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Rush pasture/mesotrophic grassland mosaic. Sward patchy. Grazing pressure high.		

Quadrat no.	Date	Grid Ref
66	16th August 2021	D2550115322

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.20m	Unshinagh

Species	%age cvr	Species	%age cvr
Calluna vulgaris	35	*Carex binervis*	20
Potentilla erecta	10		
Erica cinerea	8	*Hylocomium splendens*	15
Agrostis canina	5	*Hypnum jutlandicum*	40
Carex panicea	5	*Rhytidiadelphis squarrosus*	25
Molinia caerulea	20		
Vaccinium myrtillus	8	Bare rock	15
Dechampsia flexuosa	10	Sheep dung	5
Nardus stricta	8		
Festuca ovina	15		

Photo nos.	65	Species Total	12
NVC Code	Site & Vegetation Description		
M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *J. acutiflorus* sub-community/MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Rush pasture/mesotrophic grassland mosaic. Sward patchy. Grazing pressure high.		

Quadrat no.	Date	Grid Ref
67	16th August 2021	D2561315361

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.70m	Unshinagh

Species	%age cvr	Species	%age cvr
Erica tetralix	35	*Sphagnum capillifolium*	15
Potentilla erecta	8	*Sphagnum papillosum*	5
Polygala serpyllifolia	2	*Sphagnum denticulatum*	2
Carex panicea	15	*Hypnum jutlandicum*	15
Trichophorum germanicum	15		

Photo nos.	66	Species Total	14
NVC Code	Site & Vegetation Description		
H10a *Calluna vulgaris-Erica cinerea* heath, typical sub-community/M25 *Molinia caerulea-Potentilla erecta* mire	Dry heath/acid grassland mosaic on shallow soils. Grazing pressure moderate. *Calluna* to 25cm height. Sward open and patchy on sloping, well drained ground.		

Quadrat no.	Date	Grid Ref
68	16th August 2021	D2566315433

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.60m	Unshinagh

Species	%age cvr	Species	%age cvr
Calluna vulgaris	30	*Sphagnum papillosum*	15
Erica tetralix	15	*Hypnum jutlandicum*	8
Trichophorum germanicum	20		
Potentilla erecta	3	Sheep dung	8
Narthecium ossifragum	20		

Molinia caerulea	20	Sheep dung	3	*Molinia caerulea*	5		
Eriophorum angustifolium	10			*Polygala serpyllifolia*	2		
				Juncus squarrosus	5		
				Juncus acutiflorus	1		
				Agrostis canina	3		
Photo nos.	67	Species Total	11	Photo nos.	68	Species Total	12

NVC Code	Site & Vegetation Description	NVC Code	Site & Vegetation Description
M15 *Scirpus cespitosus-Erica tetralix* wet heath / *M25 Molinia caerulea-Potentilla erecta* mire mosaic	Blanket mire/acid grassland mosaic. Grazing pressure moderate.	M17 *Trichophorum cespitosum-Eriophorum vaginatum* mire	Blanket mire/acid grassland mosaic. Grazing pressure moderate. *Calluna* to 30cm height. Sward open and patchy.

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
69	16th August 2021	D2566315531	70	16th August 2021	D2569115641

Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.30m	Unshinagh	2m x 2m	KH	0.10m	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Agrostis canina	30	*Polytrichum commune*	5	*Calluna vulgaris*	65	*Carex panicea*	2
Juncus squarrosus	15	*Rhytidiadelphis squarrosus*	45	*Trichophorum germanicum*	20		
Potentilla erecta	8	*Hypnum jutlandicum*	40	*Potentilla erecta*	8	*Hypnum jutlandicum*	25
Deschampsia flexuosa	35			*Polygala serpyllifolia*	2	*Hylocomium splendens*	15
Galium saxatile	3	Sheep dung	3	*Deschampsia flexuosa*	3	*Rhytidiadelphis squarrosus*	35
Nardus stricta	10			*Carex flacca*	10	*Sphagnum capillifolium*	8
				Juncus squarrosus	8		
				Pedicularis sylvatica	3		
				Erica cinerea	5		
				Eriophorum vaginatum	20		
Photo nos.	69	Species Total	9	Photo nos.	70	Species Total	15

NVC Code	Site & Vegetation Description	NVC Code	Site & Vegetation Description
U2 *Deschampsia flexuosa* grassland	Acid grassland, interspersed with rush pasture in wider area. Grazing pressure moderate.	H10a *Calluna vulgaris-Erica cinerea* heath, typical sub-community	Dry heath with minor acid grassland element. Grazing pressure moderate. *Calluna* to 20cm height.

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
71	16th August 2021	D2567415780	72	16th August 2021	D2572115950

Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.30m	Unshinagh	2m x 2m	KH	0.15m	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr

Juncus acutiflorus	45	*Prunella vulgaris*	2	*Deschampsia flexuosa*	40	*Rhytidiadelphis squarrosus*	45
Euphrasia sp.	8			*Carex binervis*	3		
Taraxacum officinale agg.	10	*Sphagnum subnitens*	10	*Juncus squarrosus*	20		
Festuca ovina	5	*Rhytidiadelphis squarrosus*	45	*Anthoxanthum odoratum*	5		
Potentilla erecta	15	*Hypnum jutlandicum*	15	*Potentilla erecta*	15		
Anagallis tenella	5			*Agrostis canina*	20		
Cirsium dissectum	3	Sheep dung	5	*Nardus stricta*	10		
Leontodon autumnalis	5			*Galium saxatile*	5		
Carex flacca	10			*Molinia caerulea*	10		
Holcus lanatus	3						
Photo nos.	71	Species Total	14	Photo nos.	72	Species Total	10

NVC Code	Site & Vegetation Description	NVC Code	Site & Vegetation Description
M23a *Juncus effusus/acutiflorus-*	Rush pasture. Grazing pressure low to moderate.	U2 *Deschampsia flexuosa*	Acid grassland. Grazing pressure low to moderate.
Galium palustre rush-pasture,	Sward structure open.	grassland	Sward tight, to 40cm height. In mosaic with mesotrophic
Juncus acutiflorus sub-community			grassland dominated by *Holcus* in wider area.

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
73	16th August 2021		D2572916091		74	16th August 2021		D2570116197	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.50m	Unshinagh		2m x 2m	KH	0.60m	Unshinagh	
Species		%age cvr	Species	%age cvr	Species		%age cvr	Species	%age cvr
Deschampsia flexuosa		40	*Polytrichum commune*	20	*Eriophorum vaginatum*		80	*Sphagnum capillifolium*	15
Juncus squarrosus		25	*Sphagnum palustre*	35	*Erica tetralix*		5	*Sphagnum papillosum*	25
Galium saxatile		15	*Hylocomium splendens*	10	*Potentilla erecta*		15	*Polytrichum commune*	15
Potentilla erecta		10	*Rhytidiadelphis squarrosus*	25	*Deschampsia flexuosa*		8	*Hypnum jutlandicum*	8
Agrostis canina		8			*Empetrum nigrum*		15		
			Fungi	5	*Eriophorum angustifolium*		10		
					Drosera rotundifolia		2		

Photo nos.	73	Species Total	9	Photo nos.	74	Species Total	11

NVC Code	Site & Vegetation Description	NVC Code	Site & Vegetation Description
U2 *Deschampsia flexuosa*	Acid grassland. Grazing pressure low to moderate.	M20 *Eriophorum vaginatum*	Blanket mire with minor element of acid grassland.
grassland	Sward tight, to 40cm height.	blanket and raised mire	Grazing pressure moderate.

Quadrat no.	Date	Grid Ref
75	16th August 2021	D2565916234

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.55m	Unshinagh

Species	%age cvr	Species	%age cvr
Trichophorum germanicum	90	*Sphagnum papillosum*	15
Erica tetralix	8	*Sphagnum capillifolium*	5
Deschampsia flexuosa	3	*Hypnum jutlandicum*	10
Vaccinium myrtillus	3	*Racomitrium languinosum*	3
Narthecium ossifragum	8		

Photo nos.	75	Species Total	9

NVC Code	Site & Vegetation Description
M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire	Blanket mire with minor element of acid grassland. Grazing pressure low.

Quadrat no.	Date	Grid Ref
76	16th August 2021	D2575316179

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.40m	Unshinagh

Species	%age cvr	Species	%age cvr
Nardus stricta	90	*Sphagnum capillifolium*	8
Potentilla erecta	10	*Rhytidiadelphis squarrosus*	65
Juncus squarrosus	10	*Hylocomium splendens*	10
Carex panicea	8		
Festuca ovina	3		
Carex caryophyllea	1		
Carex binervis	2		

Photo nos.	76	Species Total	10

NVC Code	Site & Vegetation Description
U5 *Nardus stricta-Galium saxatile* grassland	Acid grassland along stream banks to 20m distance on sloping ground. Grazing pressure low to moderate.

Quadrat no.	Date	Grid Ref
77	16th August 2021	D2584416287

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.40m	Unshinagh

Species	%age cvr	Species	%age cvr
Festuca ovina	8	*Rhytidiadelphis squarrosus*	70
Agrostis capillaris	15		
Holcus lanatus	80		
Galium saxatile	15		

Photo nos.	77	Species Total	5

Quadrat no.	Date	Grid Ref
78	16th August 2021	D2584316419

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.60m	Unshinagh

Species	%age cvr	Species	%age cvr
Eriophorum angustifolium	25	*Sphagnum capillifolium*	5
Erica tetralix	15	*Hylocomium splendens*	15
Deschampsia flexuosa	20	*Rhytidiadelphis squarrosus*	45
Potentilla erecta	15	*Hypnum jutlandicum*	8
Vaccinium myrtillus	3		
Calluna vulgaris	10		
Molinia caerulea	8		
Juncus squarrosus	10		

Photo nos.	78	Species Total	12

NVC Code	Site & Vegetation Description
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland with minor element of acid grassland. Grazed by cattle. Grazing pressure moderate. Sward patchy and species-poor.

Quadrat no.	Date	Grid Ref
79	16th August 2021	D2593116495

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.20m	Unshinagh

Species	%age cvr	Species	%age cvr
Potentilla erecta	10	*Rhytidiadelphis squarrosus*	8
Deschampsia flexuosa	70	*Hypnum jutlandicum*	5
Anthoxanthum odoratum	8		
Molinia caerulea	3		
Carex binervis	15		
Deschampsia caespitosa	15		
Luzula multiflora	1		

Photo nos.	79	Species Total	9

NVC Code	Site & Vegetation Description
M3 *Eriophorum angustifolium* bog pool community, species-rich due to re-establishment of mire species after disturbance.	Blanket mire/acid grassland mosaic. Cattle grazed. Grazing pressure moderate to high. *Calluna* to 10cm height.

Quadrat no.	Date	Grid Ref
80	16th August 2021	D2601016515

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.50m	Unshinagh

Species	%age cvr	Species	%age cvr
Trichophorum germanicum	75	*Hypnum jutlandicum*	15
Potentilla erecta	8	*Racomitrium languinosum*	20
Deschampsia caespitosa	8	*Rhytidiadelphis loreus*	8
Juncus squarrosus	10		
Polygala serpyllifolia	2		
Deschampsia flexuosa	10		
Molinia caerulea	8		
Eriophorum angusitfolium	5		
Erica cinerea	3		

Photo nos.	80	Species Total	12

NVC Code	Site & Vegetation Description
U2 *Deschampsia flexuosa* grassland	Acid grassland with scattered elements of wet heath. Grazing pressure moderate. Grazed by cattle.

Quadrat no.	Date	Grid Ref
81	16th August 2021	D2619916488

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.60m	Unshinagh

Species	%age cvr	Species	%age cvr
Eriophorum angustifolium	20	*Sphagnum capillifolium*	15
Erica tetralix	15		
Juncus squarrosus	10		
Potentilla erecta	8		
Deschampsia flexuosa	8		
Eriophorum vaginatum	70		

NVC Code	Site & Vegetation Description
M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire	Blanket mire with minor element of acid grassland. Grazing pressure low to moderate.

Quadrat no.	Date	Grid Ref
82	16th August 2021	D2629516411

Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.60m	Unshinagh

Species	%age cvr	Species	%age cvr
Eriophorum vaginatum	40	*Sphagnum papillosum*	20
Eriophorum angustifolium	45	*Sphagnum capillifolium*	8
Calluna vulgaris	15	*Rhytidiadelphis squarrosus*	15
Erica tetralix	5		
Trichophorum germanicum	8		
Potentilla erecta	8		

Molinia caerulea	15	*Deschampsia flexuosa*	3
		Carex echinata	1
		Carex viridula	2

Photo nos.	81	Species Total	8	Photo nos.	82	Species Total	12
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
M20 *Eriophorum vaginatum* blanket and raised mire	Blanket mire with minor element of acid grassland. Grazing pressure low to moderate. In mosaic with acid grassland in wider area.			M20 *Eriophorum vaginatum* blanket and raised mire	Blanket mire with more patchy sward than Q80 and Q81 resulting in more well developed bryophyte layer. *Calluna* also present, to 15cm height. Grazing pressure low to moderate.		

Quadrat no.	Date	Grid Ref		Quadrat no.	Date	Grid Ref	
83	16th August 2021	D2659316351		84	16th August 2021	D2650116255	
Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.30m	Unshinagh	2m x 2m	KH	0.20m	Unshinagh
Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Holcus lanatus	95			*Holcus lanatus*	95		
Agrostis canina	10			*Agrostis canina*	10		
Anthoxanthum odoratum	3			*Anthoxanthum odoratum*	5		

Photo nos.	83	Species Total	3	Photo nos.	84	Species Total	3
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Sward patchy but dense, hence lack of bryophytes. Grazing pressure moderate.			MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Sward patchy but dense, hence lack of bryophytes. Grazing pressure moderate.		

Quadrat no.	Date	Grid Ref		Quadrat no.	Date	Grid Ref	
85	16th August 2021	D2625816062		86	16th August 2021	D2614615897	
Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.50m	Unshinagh	2m x 2m	KH	0.30m	Unshinagh
Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Holcus lanatus	90			*Holcus lanatus*	55	*Taraxacum officinale* agg.	3

Agrostis canina	20			*Juncus acutiflorus*	40		
Anthoxanthum odoratum	5			*Luzula multiflora*	3		
				Ranunculus acris	5		
				Leontodon autumnalis	5		
				Trifolium repens	8		
				Potentilla erecta	3		
				Cynosurus cristatus	5		
				Deschampsia caespitosa	20		
				Agrostis canina	15		
Photo nos.	85	Species Total	3	Photo nos.	86	Species Total	11
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Sward patchy but dense, hence lack of bryophytes. Grazing pressure moderate.			MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Rush pasture/mesotrophic grassland mosaic. Grazing pressure low. Sward patch but dense, hence lack of bryophytes.		

Quadrat no.	Date	Grid Ref		Quadrat no.	Date	Grid Ref	
87	16th August 2021	D2617515759		88	16th August 2021	D2624415643	
Quadrat size	Surveyor	Peat Depth	Site	Quadrat size	Surveyor	Peat Depth	Site
2m x 2m	KH	0.25m	Unshinagh	2m x 2m	KH	0.70m	Unshinagh
Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Juncus acutiflorus	65	*Hylocomium splendens*	15	*Anthoxanthum odoratum*	15	*Rhytidiadelphis squarrosus*	40
Cynosurus cristatus	8	*Rhytidiadelphis squarrosus*	35	*Agrostis canina*	30		
Potentilla erecta	10			*Calluna vulgaris*	10		
Anthoxanthum odoratum	3			*Juncus acutiflorus*	35		
Cirsium palustre	10			*Potentilla erecta*	10		
Ranunculus acris	10			*Molinia caerulea*	8		
Carex flacca	15			*Galium saxatile*	8		
Galium saxatile	5			*Holcus lanatus*	30		
Cirsium dissectum	5						
Photo nos.	87	Species Total	11	Photo nos.	88	Species Total	9
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus acutiflorus* sub-community	Rush pasture. Grazing pressure low. Sward more open than previous quadrats.			M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *J. acutiflorus* sub-community/MG10 Holcus lanatus-*Juncus effusus* rush-pasture	Rush pasture/mesotrophic grassland mosaic. Grazing pressure low. *Calluna* to 15cm height.		
Quadrat no.	Date	Grid Ref		Quadrat no.	Date	Grid Ref	

89		16th August 2021		D2626515550		90		16th August 2021		D2623915345	
Quadrat size	Surveyor	Peat Depth		Site		Quadrat size	Surveyor	Peat Depth		Site	
2m x 2m	KH		0.55m	Unshinagh		2m x 2m	KH		0.40m	Unshinagh	
Species		%age cvr	Species		%age cvr	Species		%age cvr	Species		%age cvr
Calluna vulgaris		35	*Eriophorum angustifolium*		3	*Calluna vulgaris*		60	*Hypnum jutlandicum*		15
Deschampsia flexuosa		5	*Eriophorum vaginatum*		25	*Molinia caerulea*		40	*Hylocomium splendens*		25
Erica cinerea		3				*Erica cinerea*		35			
Erica tetralix		10	*Polytrichum piliferum*		10	*Potentilla erecta*		8	Sheep dung		5
Molinia caerulea		8	*Camplyopus introflexus*		8						
Potentilla erecta		8	*Racomitrium languinosum*		15						
Trichophorum germanicum		10									
Danthonia decumbens		2	Bare peat		15						
Narthecium ossifragum		15	Sheep dung		5						
Carex echinata		3									
Photo nos.		89	Species Total		15	Photo nos.		90	Species Total		6
NVC Code		Site & Vegetation Description				NVC Code		Site & Vegetation Description			
M19a *Calluna vulgaris-Eriophorum vaginatum* blanket mire, *Erica tetralix* subcommunity/M25 *Molinia caerulea-Potentilla erecta* mire		Blanket mire with minor element of acid grassland. Grazing pressure low to moderate. Sward open and patchy with thin underlying peat. *Calluna* to 15cm tall. Bryophytes suggest previous fire at this location.				H10a *Calluna vulgaris-Erica cinerea* heath, typical sub-community		Dry heath with minor element of acid grassland. Grazing pressure low. *Calluna* to 30cm height. Sward patchy.			

Quadrat no.	Date		Grid Ref		Quadrat no.	Date		Grid Ref	
91	16th August 2021		D2615115386		92	16th August 2021		D2601515423	
Quadrat size	Surveyor	Peat Depth	Site		Quadrat size	Surveyor	Peat Depth	Site	
2m x 2m	KH	0.30m	Unshinagh		2m x 2m	KH	0.20m	Unshinagh	
Species	%age cvr	Species		%age cvr	Species		%age cvr	Species	%age cvr
Agrostis canina	20	*Rhytidiadelphis squarrosus*		35	*Calluna vulgaris*		15	*Pedicularis sylvatica*	5
Anthoxanthum odoratum	30				*Erica cinerea*		5	*Anthoxanthum odoratum*	8
Deschampsia flexuosa	35	Sheep dung		8	*Deschampsia flexuosa*		20		
Holcus lanatus	15				*Potentilla erecta*		15	*Hylocomium splendens*	15
Potentilla erecta	15				*Agrostis capillaris*		15	*Rhytidiadelphis squarrosus*	20
Luzula multiflora	1				*Galium saxatile*		5		
Carex binervis	3				*Carex panicea*		3		
					Carex binervis		2		
					Holcus lanatus		5		
					Molinia caerulea		20		
Photo nos.	91	Species Total		8	Photo nos.		92	Species Total	14
NVC Code	Site & Vegetation Description				NVC Code		Site & Vegetation Description		

U2 *Deschampsia flexuosa* grassland		Acid grassland/mesotrophic grassland mosaic. Grazing pressure moderate. Sward open and patchy.		U2 *Deschampsia flexuosa* grassland/H10a *Calluna vulgaris-Erica cinerea* heath		Dry heath/acid grassland mosaic. Grazing pressure moderate. *Calluna* to 15cm height. Sward open and patchy.	
Quadrat no. 93	Date 16th August 2021	Grid Ref D2591115350		Quadrat no. 94	Date 16th August 2021	Grid Ref D2624915152	
Quadrat size 2m x 2m	Surveyor KH	Peat Depth 0.20m	Site Unshinagh	Quadrat size 2m x 2m	Surveyor KH	Peat Depth 0.70m	Site Unshinagh
Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Holcus lanatus	30	*Rhytidiadelphis squarrosus*	15	*Calluna vulgaris*	5	*Rhytidiadelphis squarrosus*	20
Juncus acutiflorus	45	*Hylocomium splendens*	35	*Molinia caerulea*	60	*Hylocomium splendens*	30
Cynosurus cristatus	15			*Erica cinerea*	10		
Anthoxanthum odoratum	8			*Trichophorum germanicum*	20	Sheep dung	5
Potentilla erecta	10			*Potentilla erecta*	8		
Trifolium repens	15			*Narthecium ossifragum*	10		
Festuca ovina	3			*Deschampsia caespitosa*	3		
Galium saxatile	10						
Photo nos.	93	Species Total	10	Photo nos.	94	Species Total	9
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *J. acutiflorus* sub-community/MG10 Holcus lanatus-*Juncus effusus* rush-pasture	Rush pasture/mesotrophic grassland mosaic. Grazing pressure low to moderate. Sward patchy and open.			M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community/H10a *Calluna vulgaris Erica cinerea* heath	Acid grassland/dry heath mosaic. Grazing pressure moderate. *Calluna* to 10cm height. Peat shallow.		
Quadrat no. 95	Date 16th August 2021	Grid Ref D2621015002		Quadrat no. 96	Date 18th November 2021	Grid Ref D2561515762	
Quadrat size 2m x 2m	Surveyor KH	Peat Depth 0.10m	Site Unshinagh	Quadrat size 2m x 2m	Surveyor KH		Site Unshinagh
Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Pteridium aquilinum	10	*Anthoxanthum odoratum*	8	*Juncus effusus*	55		
Cirsium vulgare	8	*Carex nigra*	2	*Deschampsia caespitosa*	5		
Agrostis capillaris	5			*Cirsium palustre*	10		
Cirsium arvense	8	*Calliergonella cuspidatum*	15	*Trifolium repens*	8		
Cirsium palustre	10	*Rhytidiadelphis squarrosus*	25	*Juncus acutiflorus*	15		
Juncus effusus	10			*Holcus lanatus*	20		
Ulex europaeus	10	Bare peat	15				

Trifolium repens	25		
Festuca rubra	5	Last quadrat from initial habitat	
Holcus lanatus	25	mapping	

Photo nos.	95	Species Total	14	Photo nos.	96	Species Total	6
NVC Code	Site & Vegetation Description			NVC Code Starts as PM32 on ipad	Site & Vegetation Description		
MG10 *Holcus lanatus-Juncus effusus* rush-pasture	Mesotrophic grassland. Grazing pressure high. Cattle- and sheep-grazed. Sward open and very patchy.			M23b *Juncus effusus/acutiflorus - Galium saxatile* rush pasture, *Juncus effusus* sub-community	Rush pasture with fringes and area to north dominated by *Nardus* acid grassland. Sward patchy, to 55cm height. Grazing pressure low. Sward species-poor.		

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
97	18th November 2021	D2575515792	98	18th November 2021	D2572515997
Quadrat size	Surveyor	Site	Quadrat size	Surveyor	Site
2m x 2m	KH	Unshinagh	2m x 2m	KH	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Juncus acutiflorus	40	*Rhytidiadelphis squarrosus*	15	*Trichophorum germanicum*	25	*Sphagnum capillifolium*	40
Nardus stricta	45	*Hylocomium splendens*	80	*Potentilla erecta*	8	*Polytrichum commune*	10
Trichophorum germanicum	8			*Nardus stricta*	30	*Pseudoscleropodium purum*	3
Potentilla erecta	5			*Deschampsia caespitosa*	15	*Rhytidiadelphis sqaurrosus*	8
Galium saxatile	8			*Vaccinium myrtillus*	5	*Hylocomium splendens*	10
Festuca ovina	5			*Erica tetralix*	3		
Molinia caerulea	8			*Molinia caerulea*	10		

Photo nos.	97	Species Total	7	Photo nos.	98, 99	Species Total	12
NVC Code	Site & Vegetation Description			NVC Code	Site & Vegetation Description		
	Rush pasture/acid grassland mosaic on shallow soil with rock outcrops nearby. Sward patchy and open. Grazing pressure moderate.				Acid grassland/blanket mire mosaic. Sward open. Grazing pressure moderate. Narrow band of M20a blanket mire cutting across mosaic from west to east (Photo 99) but enclosed entirely within acid grassland.		

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
99	18th November 2021	D2574316177	100	18th November 2021	D2583416418
Quadrat size	Surveyor	Site	Quadrat size	Surveyor	Site
2m x 2m	KH	Unshinagh	2m x 2m	KH	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Trichophorum germanicum	70	*Racomitrium languinosum*	3	*Eriophorum vaginatum*	60	*Rhytidiadelphis squarrosus*	25
Erica tetralix	10	*Sphagnum fallax*	15	*Deschampsia flexuosa*	3	*Rhytidiadelphis loreus*	35

Juncus squarrosus	10	*Pseudoscleropodium purum*	15	*Vaccinium myrtillus*	8	*Hylocomium splendens*	40
Potentilla erecta	8	*Sphagnum palustre*	5	*Luzula multiflora*	1		
Carex nigra	5			*Festuca ovina*	20		
Eriophorum angusitfolium	3	Sheep dung	8	*Eriophorum angustifolium*	10		

Photo nos.	100	Species Total	10	Photo nos.	101	Species Total	9
NVC Code	Site & Vegetation Description Blanket mire on shallow soils with rocky outcrops nearby. Sward patchy. Grazing pressure moderate to high.			NVC Code	Site & Vegetation Description Blanket mire/acid grassland mosaic over deep peat; blanket mire element fragmented among acid grassland and rush pasture within wider area. Grazing pressure moderate.		

Quadrat no.	Date	Grid Ref	Quadrat no.	Date	Grid Ref
101	18th November 2021	D2606316555	102	18th November 2021	D2487515782
Quadrat size	Surveyor	Site	Quadrat size	Surveyor	Site
2m x 2m	KH	Unshinagh	2m x 2m	KH	Unshinagh

Species	%age cvr	Species	%age cvr	Species	%age cvr	Species	%age cvr
Trichophorum germanicum	70	*Racomitrium languinosum*	25	*Trichophorum germanicum*	55	*Sphagnum capillifolium*	20
Potentilla erecta	8	*Hypnum jutlandicum*	10	*Empetrum nigrum*	15	*Hypnum jutlandicum*	30
Eriophorum angustifolium	10	*Dicranum scoparium*	5	*Erica tetralix*	5	*Rhytidiadelphis loreus*	8
Erica tetralix	5			*Molinia caerulea*	30		
Molinia caerulea	25			*Vaccinium myrtillus*	3		
Deschampsia flexuosa	5			*Potentilla erecta*	5		
Empetrum nigrum	3			*Juncus squarrosus*	10		
				Eriophorum angustifolium	5		

Photo nos.	102	Species Total	10	Photo nos.	103	Species Total	11
NVC Code	Site & Vegetation Description Blanket mire/acid grassland mosaic on deep peat. Sward patchy. Grazing pressure low.			NVC Code	Site & Vegetation Description Blanket mire/acid grassland mosaic. Sward patchy. Grazing pressure moderate.		

Quadrat no.	Date	Grid Ref
103	18th November 2021	D2467615443

Quadrat size	Surveyor	Site
2m x 2m	KH	Unshinagh

Species	%age cvr	Species	%age cvr
Trichophorum germanicum	25	*Sphagnum capillifolium*	10
Molinia caerulea	70	*Sphagnum papillosum*	3
Empetrum nigrum	15		
Erica tetralix	8		
Potentilla erecta	8		
Vaccinium myrtillus	3		
Eriophorum vaginatum	5		
Eriophorum angustifolium	8		

Photo nos.	104	Species Total	10

NVC Code	Site & Vegetation Description
	Blanket mire/acid grassland mosaic. Sward patchy.
	Grazing pressure low to moderate.

Part 1d: NVC Quadrat Data (Infrastructure focused)

Site:	**Unshinagh**			
Date:	03/11/2021	17/11/2021	17/11/2021	18/11/2021
Habitat type:	Rush pasture			
Group no:	RP1	RP2	RP1	RP1
NVC habitat type:	M23a	M25	M25	M23
Recorder:	FS	FS	FS	FS
Notes:	Rush pasture on gentle slope with SE aspect. Moderate poaching by cattle, wet in hollows.	Rush pasture, very wet and a little spongy underfoot. Very slight incline with northern aspect	Rush pasture. Wet and spongy underfoot	Quadrat of wet grassland situated beside a small soakway with water mint
Grid ref (ITM):	726825, 914226	726410, 914076	726117, 915732	724820, 913233
Quadrat no:	**Q1**	**Q3**	**Q9**	**Q24**
Peat depth (cm):	0	90	30	40
Average sward height:	75/15	60/40	50/30	50
Max vegetation height:	100	120	60	85
Species	**% cover**	**% cover**	**% cover**	**% cover**
Achillea ptarmica	2			2
Agrostis canina sens.lat.	5		10	
Agrostis capillaris			5	
Agrostis stolonifera				2
Calliergon cuspidatum	15			
Cardamine flexuosa	2			1
Carex diandra	1	1		
Carex echinata	1		5	
Carex hirta	<1			
Carex nigra			1	
Carex rostrata				2
Cerastium fontanum	1			
Cynosurus cristatus	4			
Deschampsia cespitosa				10
Epilobium palustre	1			
Festuca ovina agg.		15		
Festuca ovina agg.			5	
Festuca rubra agg.	5			5
Galium palustre	1			<1
Galium saxatile		1		
Holcus lanatus	20	10		20
Hylocomium splendens		10	7	
Hypnum jutlandicum			3	
Juncus acutiflorus	2	20	60	45
Juncus conglomeratus				7
Juncus effusus	40			
Lophocolea bidentata sens.lat.	<1			
Mentha aquatica				1

Molinia caerulea		45		
Nardus stricta			10	
Pleurozium schreberi			1	
Potentilla erecta		1	1	
Pseudoscleropodium purum		3		
Ranunculus acris	4			7
Ranunculus flammula	1			
Rhytidiadelphus squarrosus	7	5		2
Rumex acetosa	1			1
Schedonorus arundinaceus	10	7		20
Senecio aquaticus	3		2	1
Sphagnum capillifolium			10	
Sphagnum palustre			2	
Sphagnum russowii		10		
Sphagnum subnitens			3	
Succisa pratensis		3		
Trifolium repens	2			
Vaccinium oxycoccos		2		
Viola seedling/sp			1	
Bare ground/litter/water/rock/mud	4			

Group RP1, Quadrat 1

Group RP2, Quadrat 3

Group RP1, Quadrat 9

Group RP1, Quadrat 24

Site:	**Unshinagh**		
Habitat type:	Blanket bog		
Date:	17/11/2021	04/11/2021	16/11/2021
Recorder:	FS	FS	FS
NVC habitat type:	M17	M17	M17
Notes:	Small patch of blanket bog with deep peat in area of wet heath. Ground spongy, level in slight hollow	Flat area at bottom of a small hill. Shallow peat	
Grid ref (ITM):	726574, 914113	725616, 915696	724773, 915227
Quadrat no:	**Q2**	**Q19**	**Q22**
Peat depth (cm):	>100	100	>100
Average sward height:	15	20	20
Max vegetation height:	60	55	35
Species	**% cover**	**% cover**	**% cover**
Agrostis canina sens.lat.		25	
Aulacomnium palustre	5		
Calluna vulgaris	18	5	15
Carex nigra			
Cladonia portentosa			7
Deschampsia flexuosa			
Dicranum scoparium			
Empetrum nigrum			
Erica tetralix		12	7
Eriophorum angustifolium		10	3
Eriophorum vaginatum	25	5	
Festuca ovina agg.			
Galium saxatile	2		
Hylocomium splendens			
Hypnum jutlandicum			2
Juncus acutiflorus			
Juncus squarrosus			
Luzula multiflora			
Molinia caerulea	10		
Mushroom	<1		
Nardus stricta		15	
Narthecium ossifragum			40
Pleurozium schreberi	10		
Polygala [spp]		1	
Polytrichum commune	10		
Potentilla erecta	2	2	
Pseudoscleropodium purum			
Racomitrium lanuginosum			
Rhytidiadelphus loreus			
Rhytidiadelphus			

squarrosus			
Sphagnum capillifolium	35	7	5
Sphagnum cuspidatum	7	3	5
Sphagnum papillosum		10	2
Sphagnum fallax			
Sphagnum subnitens	3		
Trichophorum germanicum		70	35
Vaccinium myrtillus	2		5
Bare ground/litter/water /rock/mud	3	2	2

Group BB, Quadrat 2

Group BB, Quadrat 19

Group BB, Quadrat 22

Site:	Unshinagh			
Habitat type:	Heath			
Date:	17/11/2021	04/11/2021	17/11/2021	03/11/2021
Recorder:	FS	FS	FS	FS
NVC habitat type:	M15	M15	M15	M15
Notes:	Dry heath over thin stony ground in mosaic with Molinia acid grassland. Situated near top of a small hill with gentle SW aspect	Somewhat spongy, mostly flat ground	small patch of heath showing through acid grassland. Ground firm. Gentle slope with southern aspect	Dry firm ground on top of hill
Grid ref (ITM):	726185, 915161	726179, 915346	725915, 915393	725084, 915116
Quadrat no:	**Q4**	**Q5**	**Q6**	**Q23**
Peat depth (cm):	30	75	20	70
Average sward height:	15	25	35	27
Max vegetation height:	55	50	85	60
Species	**% cover**	**% cover**	**% cover**	**% cover**
Agrostis stolonifera			15	
Anthoxanthum odoratum			1	
Calluna vulgaris	30	70	40	45
Carex echinata	<1		<1	
Carex nigra	1	1		
Carex panicea	1			
Cirsium palustre			4	
Deschampsia cespitosa				5
Erica cinerea	3		2	
Erica tetralix		15		1
Festuca rubra agg.				60
Galium saxatile			1	
Hylocomium splendens			15	3
Hypnum jutlandicum	5			2
Juncus squarrosus	25	25		
Molinia caerulea	35	15	15	1
Nardus stricta	15		8	
Narthecium ossifragum	1			
Pedicularis sylvatica			3	
Pleurozium schreberi				3
Polygala [spp]	<1			
Polytrichum commune				
Potentilla erecta	2	2	1	1
Pseudoscleropodium purum			1	

Rhytidiadelphus loreus	4	2	2	
Rhytidiadelphus squarrosus	1		5	5
Sphagnum capillifolium	15			
Sphagnum cuspidatum				5
Sphagnum papillosum		2		
Sphagnum fallax		55		
Sphagnum subnitens				10
Trichophorum germanicum	10			
Vaccinium myrtillus				3
Bare ground/litter/water/ rock/mud	3	2	2	

Group H, Quadrat 4

Group H, Quadrat 5

Group H, Quadrat 6

Group H, Quadrat 23

Site:	Unshinagh																	
Date:	3rd, 4th, 16th, 17th and 18th November 2021																	
Recorder:	Flor Spaans, Blackstaff Ecology																	
Group no:	3																	
Habitat type:	Wet heath																	
NVC habitat type:	M15																	
Notes:	wet heath on top of a small rise. Ground wet and spongy. Soil shallow over rocks but can occasionally be deeper in dips.	Patch of heath in mosaic with rush pasture. Soil shallow on gentle slope with northern aspect	Wet heath on top of hill with shallow soil	Narrow strip of wet heath with a fence running through it.	Wet heath on wet and spongy ground with very slight slope to the east	Mostly flat area on top of small hill. Wet underfoot	wet heath in depression beside rocky outcrop. Mainly less than .5 m deep but up to 80cm in places. Wet and spongy	North eastern slope, spongy underfoot	Strip of wet heath running up to the treeline with rush pasture acid grassland on slightly higher ground	wet heath acid grassland mosaic. SE aspect of a gentle rise	Flat area at bottom of a small hill. Shallow peat	wet heath at top of a steep NE facing slope	Wet heath with occasional small patches of deeper peat. Ground soft and spongy. Situated on lower slopes of North facing hill	Strip of wet heath situated between two hillocks with acid grassland	Patch of wet heath severely degraded by livestock. Quadrat taken on a relatively intact area near the edge. Ground flat, wet and spongy	Heavy poaching, wet and soft ground. Wet heath patch in acid grassland	Wet and soft underfoot with some standing water. Near small drier hillock with acid grassland and drier patches of rushes	Slightly wetter area in shallow hollow. Ground wet and spongy
Grid ref:	726181, 915391	726183, 915549	726121, 916430	724879, 913712	724674, 913297	725874, 916489	724656, 913237	725577, 916260	724962, 913045	725372, 914655	725660, 916066	725065, 915170	724973, 915336	724728, 913351	724788, 913521	724784, 913508	724622, 913275	724883, 913707
Quadrat no:	**Q7**	**Q8**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q20**	**Q21**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**
Peat depth (cm):	45	20	30	60	48	35	45	25	35	40	25	40	20-80	60	30	25	75	40
Average sward height:	30	20	25	25	15	15	15	25	10	45	15	15	27	15	15	20	20	27

Max vegetation height:	70	45	65	100	50	45	70	50	40	100	55	45	65	65	50	55	70	75
Species	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**	**% cover**
Agrostis canina sens.lat.						5					35			1		15		2
Agrostis capillaris		5													3			
Aulacomnium palustre				10	7				6	3				3	5		4	25
Calliergon cuspidatum									1									
Calluna vulgaris	65	35	30	5	10		3			5		5		1	1	5	5	3
Campylopus introflexus																	2	
Carex binervis					2		15							3				
Carex diandra													3					
Carex echinata	10		2	4	3		7		15	4			1	5	15	1		2
Carex nigra					1	2								2		25		
Carex panicea		1			2		7		2	3				5				
Carex viridula subsp.oedocarpa	1				1		1							1				
Deschampsia cespitosa										30								
Deschampsia flexuosa												30	60	1				
Empetrum nigrum				1				4		<1		1						
Erica cinerea						<1												
Erica tetralix	4	25	4	5	3	5	5	30		12		7	10	1	2	1	4	3
Eriophorum angustifolium			2	3			1	3	1				2			1		5

Eriophorum vaginatum				15				10					5	12	6			20
Festuca rubra agg.	4								3									
Galium saxatile										4	2	<1	<1					
Hylocomium splendens	5				4		1			1	25				1			
Hypnum jutlandicum							1		2			7	2			5	2	
Juncus acutiflorus					1		3				12							
Juncus conglomeratus								7										
Juncus effusus																	<1	
Juncus squarrosus	7		5	15		20		15	20			12						4
Luzula multiflora												1						
Molinia caerulea	25	20	30		17	10	20		5	15	2	15	40	7	5	25	7	5
Nardus stricta	10					50				7	5			3	2	10		
Narthecium ossifragum		4	2		7		7								5		<1	
Pedicularis sylvatica		1			2													
Pleurozium schreberi	2							4		4								
Polygala [spp]		<1	<1		<1		1			1			1	1		<1	2	<1
Polytrichum commune				2		1		<1	5	3	5	7		3				2
Potentilla erecta	1	1	2	1	1	2	2		3	2		2		1		2		1
Pseudoscleropodium purum	1									3		4						
Rhytidiadelphus loreus				2	2	1			2	2		5		3			1	
Rhytidiadelphus squarrosus							2		1		4	10		2	1			

Schedonorus arundinaceus							3										
Sphagnum auriculatum							2							5	20	10		
Sphagnum capillifolium	15		25	18	12	5	20	5	40	20	15	20	8	45	15		15	20
Sphagnum cuspidatum				4					20					5	10	3		3
Sphagnum fimbriatum					2													
Sphagnum palustre	3				5		25		10	5			2		5		3	
Sphagnum papillosum			10	20		25		25			30		5	15	20	10		
Sphagnum fallax												5						
Sphagnum subnitens	4			2						5								20
Sphagnum teres	3		3															
Succisa pratensis					3													
Trichophorum germanicum	3	35	45					30					3	2	2			
Vaccinium myrtillus				<1								2		<1				
Viola sp										1								
Bare ground/litter/water/rock/mud				6	4	2	3								8	12	4	

Group 3 (wet heath), quadrats 7, 8, 10 and 11 (left to right, top to bottom)

Group 3 (wet heath), quadrats 12, 13, 14 and 15 (left to right, top to bottom)

Group WH
(wet heath), quadrats 16, 17, 18 (left to right, top to bottom)

Group WH (wet heath), quadrats 20, 21, 25 and 26 (left to right, top to bottom)

Group WH (wet heath), quadrats 27, 28 and 29 (left to right, top to bottom)

MAVIS results

Group 0: Rush pasture 1
NVC: M25 50.40
NVC: M15 46.30
NVC: M15d 45.70
NVC: M6 45.28
NVC: M25a 45.17
NVC: M6d 45.05
NVC: U4d 43.58
NVC: M25b 42.99
NVC: M15b 42.39
NVC: M23a 42.26

Group 1: Rush pasture 2
NVC: M25a 54.50
NVC: M15 54.26
NVC: M25 53.13
NVC: M6d 52.72
NVC: M6 52.22
NVC: M15b 51.35
NVC: M15d 49.82
NVC: M15c 49.49
NVC: M17 47.32
NVC: M17b 46.38

Group 0: Blanket bog
NVC: M17c 67.04
NVC: M19a 67.03
NVC: M17 65.06
NVC: M15 63.78
NVC: M15d 63.71
NVC: M17b 59.55
NVC: M15b 59.45
NVC: M19 56.75
NVC: M15c 56.62
NVC: M25a 54.73

Group 2: Heath
NVC: M15 65.40
NVC: M17c 61.65
NVC: M15d 61.50
NVC: M15b 61.09
NVC: M17 58.51
NVC: M15c 57.93
NVC: M17b 55.68
NVC: M17a 54.28
NVC: M19a 53.17
NVC: M6a 51.44

Group 3: Wet heath
NVC: M15 67.00
NVC: M15b 66.23
NVC: M15d 60.99
NVC: M17c 60.25
NVC: M17 59.08
NVC: M6 58.29
NVC: M25a 57.31
NVC: M15c 56.64
NVC: M6d 56.29
NVC: M17b 55.53

Part 2a: Static (Bat) Detector Deployment Photos

Spring Deployment

T1

Anabat Express with v3 microphone deployed at turbine location.

T2

SM4 ZC with SMM-U1 microphone deployed at turbine location.

T4

SM4 ZC with SMM-U1 microphone deployed at turbine location.

T5

SM2 Bat+ with SMX-U1 microphone deployed at turbine location.

T6

SM2 Bat+ (Full Spectrum) with SMX-U1 microphone deployed at turbine location.

T7

SM4 ZC with SMM-U1 microphone deployed at turbine location.

T8

Anabat Express with v3 microphone deployed at turbine location.

T9

SM2 Bat+ with SMX-U1 microphone deployed at turbine location.

T10

SM2 Bat+ with SMX-U1 microphone deployed at turbine location.

T11

SM4 ZC with SMM-U1 microphone deployed close to turbine Location.

T12

SM2 Bat+ with SMX-U1 microphone deployed at turbine location.

T14

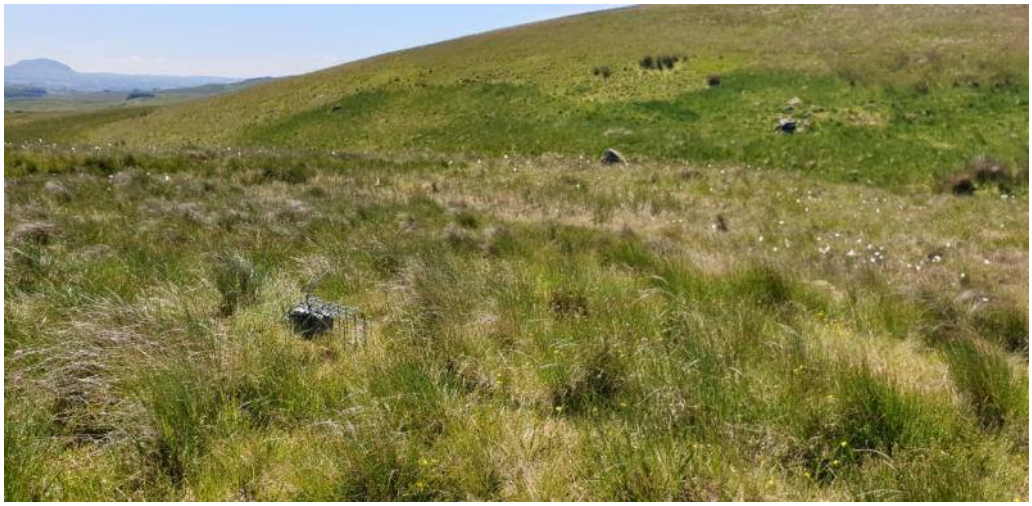
SM2 Bat+ with SMX-U1 microphone deployed at turbine location.

Early Summer Deployment

T2

Anabat Express with v3 microphone deployed at turbine Location.

T4



Anabat Express with v3 microphone deployed at turbine Location.

T7

Anabat Express with v3 microphone deployed at turbine Location.

T9

Anabat Express with v3 microphone deployed at turbine Location.

T10

Anabat Express with v3 microphone deployed at turbine Location.

Late Summer Deployment

T1

Anabat Express with v3 microphone deployed close to turbine Location.

T3

SM4 ZC with SMM-U1 microphone close to turbine Location.

T4

SM2 Bat+ with SMX-U1 microphone deployed at turbine Location.

T5

SM2 Bat+ (Full Spectrum) with SMX-U1 microphone deployed at turbine Location.

T6

SM2 Bat+ with SMX-U1 microphone deployed at turbine Location.

T7

Anabat Express with v3 microphone deployed close to turbine Location.

T8

Anabat Express with v3 microphone deployed at turbine Location.

T9

SM2 Bat+ with SMX-U1 microphone deployed at turbine Location.

T10

Anabat Express with v3 microphone deployed at turbine Location.

T11

Anabat Express with v3 microphone deployed close to turbine Location.

T12

Anabat Express with v3 microphone deployed at turbine Location.

T13

Anabat Express with v3 microphone deployed at turbine Location.

Autumn Deployment

T1

Anabat Express with v3 microphone deployed close to turbine Location.

T2

SM2 Bat+ with SMX-U1 microphone deployed at turbine Location.

T3

Anabat Express with v3 microphone close to turbine Location.

T3 (2nd Deployment in early October)

Anabat Express with v3 microphone deployed close to turbine Location.

T4

SM2 Bat+ with SMX-U1 microphone deployed at turbine Location.

T5

SM2 Bat+ with SMX-U1 microphone deployed at turbine Location.

T6

Anabat Express with v3 microphone deployed at turbine Location.

T7

SM4 ZC with SMM-U1 microphone deployed close to turbine Location.

T8

SM4 ZC with SMM-U1 microphone deployed close to turbine Location.

T9

SM2 Bat+ with SMX-U1 microphone deployed at turbine Location.

T10

SM2 Bat+ (Full Spectrum) with SMX-U1 microphone deployed at turbine Location.

T11

SM4 ZC with SMM-U1 microphone deployed close to turbine Location.

T12

SM2 Bat+ with SMX-U1 microphone deployed at turbine Location.

T13

SM4 ZC with SMM-U1 microphone deployed at turbine Location.

Part 2b: Static (Bat) Detector Data

Spring

T1

	MYODAU	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210521	0	0	0	0	**0**	**0.0**
20210522	0	0	0	0	**0**	**0.0**
20210523	0	0	0	0	**0**	**0.0**
20210524	0	0	0	0	**0**	**0.0**
20210525	0	0	0	0	**0**	**0.0**
20210526	0	0	1	0	**1**	**0.1**
20210527	0	3	33	1	**37**	**4.9**
20210528	0	0	20	2	**22**	**2.9**
20210529	1	1	5	0	**7**	**0.9**
20210530	0	1	7	1	**9**	**1.2**
Species Total	**1**	**5**	**66**	**4**	**76**	
Passes per hour	**0.01**	**0.07**	**0.88**	**0.05**	**1.01**	

T2

NO DATA

T4

NO DATA

T5

	MYODAU	MYONAT	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210521	0	0	0	0	0	**0**	**0.0**
20210522	0	0	0	0	0	**0**	**0.0**
20210523	0	0	0	0	0	**0**	**0.0**
20210524	0	0	0	0	0	**0**	**0.0**
20210525	0	0	0	0	0	**0**	**0.0**
20210526	0	0	0	0	0	**0**	**0.0**
20210527	0	2	11	10	15	**38**	**5.1**
20210528	0	0	59	22	6	**87**	**11.6**
20210529	4	1	16	4	6	**31**	**4.1**
20210530	2	0	16	5	2	**25**	**3.3**
Species Total	**6**	**3**	**102**	**41**	**29**	**181**	
Passes per hour	**0.08**	**0.04**	**1.36**	**0.55**	**0.39**	**2.41**	

T6 (Full Spectrum)

	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210521	0	0	0	**0**	**0.0**
20210522	0	0	0	**0**	**0.0**
20210523	0	0	0	**0**	**0.0**
20210524	0	0	0	**0**	**0.0**
20210525	0	0	0	**0**	**0.0**
20210526	0	0	0	**0**	**0.0**
20210527	0	8	5	**13**	**1.7**
20210528	1	4	0	**5**	**0.7**
20210529	2	4	4	**10**	**1.3**
20210530	0	3	0	**3**	**0.4**
Species Total	**3**	**19**	**9**	**31**	
Passes per hour	**0.04**	**0.25**	**0.12**	**0.41**	

T7

	MYODAU	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210521	0	0	0	0	**0**	**0.0**
20210522	0	0	0	0	**0**	**0.0**
20210523	0	0	0	0	**0**	**0.0**
20210524	0	0	0	0	**0**	**0.0**
20210525	0	0	0	0	**0**	**0.0**
20210526	1	0	0	0	**1**	**0.1**
20210527	0	226	29	11	**266**	**35.5**
20210528	0	96	46	59	**201**	**26.8**
20210529	0	36	6	5	**47**	**6.3**
20210530	1	79	115	53	**248**	**33.1**
Species Total	**2**	**437**	**196**	**128**	**763**	
Passes per hour	**0.03**	**5.83**	**2.61**	**1.71**	**10.17**	

T8

	MYODAU	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210521	0	0	0	0	**0**	**0.0**
20210522	0	0	2	1	**3**	**0.4**
20210523	0	0	1	0	**1**	**0.1**
20210524	0	0	0	0	**0**	**0.0**
20210525	1	0	1	0	**2**	**0.3**
20210526	0	0	1	0	**1**	**0.1**
20210527	0	7	21	12	**40**	**5.3**
20210528	0	7	51	22	**80**	**10.7**
20210529	1	2	7	4	**14**	**1.9**
20210530	0	4	35	7	**46**	**6.1**
Species Total	**2**	**20**	**119**	**46**	**187**	
Passes per hour	**0.03**	**0.27**	**1.59**	**0.61**	**2.49**	

T9

	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210519	0	1	0	**1**	**0.1**
20210520	0	0	0	**0**	**0.0**
20210521	0	0	0	**0**	**0.0**
20210522	0	0	0	**0**	**0.0**
20210523	0	0	0	**0**	**0.0**
20210524	0	0	0	**0**	**0.0**
20210525	1	18	2	**21**	**2.8**
20210526	0	0	0	**0**	**0.0**
20210527	1	518	51	**570**	**76.0**
20210528	3	321	66	**390**	**52.0**
Species Total	**5**	**858**	**119**	**982**	
Passes per hour	**0.07**	**11.44**	**1.59**	**13.09**	

T10

	MYODAU	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210519	0	8	4	0	**12**	**1.6**
20210520	0	0	0	0	**0**	**0.0**
20210521	2	0	0	0	**2**	**0.3**
20210522	0	0	7	0	**7**	**0.9**
20210523	0	0	0	0	**0**	**0.0**
20210524	0	1	0	0	**1**	**0.1**
20210525	0	0	0	0	**0**	**0.0**
20210526	0	0	0	0	**0**	**0.0**
20210527	0	0	0	0	**0**	**0.0**
20210528	0	357	386	17	**760**	**101.3**
20210529	1	97	245	6	**349**	**46.5**
Species Total	**3**	**455**	**638**	**23**	**1119**	
Passes per hour	**0.04**	**6.07**	**8.51**	**0.31**	**14.92**	

T11

	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210519	0	0	0	**0**	**0.0**
20210520	0	0	0	**0**	**0.0**
20210521	0	0	0	**0**	**0.0**
20210522	0	0	0	**0**	**0.0**
20210523	0	0	0	**0**	**0.0**
20210524	0	0	0	**0**	**0.0**
20210525	0	0	0	**0**	**0.0**
20210526	0	0	0	**0**	**0.0**
20210527	3	6	3	**12**	**1.6**
20210528	26	4	6	**36**	**4.8**
Species Total	**29**	**10**	**9**	**48**	
Passes per hour	**0.39**	**0.13**	**0.12**	**0.64**	

T12

	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210519	0	0	0	**0**	**0.0**
20210520	0	0	0	**0**	**0.0**
20210521	0	0	0	**0**	**0.0**
20210522	0	0	0	**0**	**0.0**
20210523	0	0	0	**0**	**0.0**
20210524	0	0	0	**0**	**0.0**
20210525	0	0	0	**0**	**0.0**
20210526	0	1	0	**1**	**0.1**
20210527	2	4	1	**7**	**0.9**
20210528	16	3	5	**24**	**3.2**
Species Total	**18**	**8**	**6**	**32**	
Passes per hour	**0.24**	**0.11**	**0.08**	**0.43**	

T14

	MYODAU	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210519	0	0	0	0	**0**	**0.0**
20210520	0	0	0	0	**0**	**0.0**
20210521	0	0	0	0	**0**	**0.0**
20210522	0	0	0	0	**0**	**0.0**
20210523	1	0	0	0	**1**	**0.1**
20210524	0	0	0	0	**0**	**0.0**
20210525	0	1	3	0	**4**	**0.5**
20210526	0	0	0	0	**0**	**0.0**
20210527	0	1	99	51	**151**	**20.1**
20210528	0	22	126	58	**206**	**27.5**
Species Total	**1**	**24**	**228**	**109**	**362**	
Passes per hour	**0.01**	**0.32**	**3.04**	**1.45**	**4.83**	

Summer (Early)

T2

	NYCLEI	TOTAL	BAI
20210629	0	**0**	**0.0**
20210630	9	**9**	**1.3**
20210701	1	**1**	**0.1**
20210702	1	**1**	**0.1**
20210703	1	**1**	**0.1**
20210704	3	**3**	**0.4**
20210705	0	**0**	**0.0**
20210706	2	**2**	**0.3**
20210707	1	**1**	**0.1**
20210708	16	**16**	**2.4**
Species Total	**34**	**34**	
Passes per hour	**0.5**	**0.5**	

T4

	MYONAT	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210629	0	0	0	0	**0**	**0.0**
20210630	0	13	3	3	**19**	**2.8**
20210701	1	12	4	1	**18**	**2.7**
20210702	0	17	4	1	**22**	**3.3**
20210703	0	24	1	2	**27**	**4.0**
20210704	0	74	8	3	**85**	**12.6**
20210705	0	57	1	0	**58**	**8.6**
20210706	0	10	0	0	**10**	**1.5**
20210707	0	18	1	0	**19**	**2.8**
20210708	0	48	3	1	**52**	**7.7**
Species Total	**1**	**273**	**25**	**11**	**310**	
Passes per hour	**0.0**	**4.0**	**0.4**	**0.2**	**4.6**	

T7

	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210629	0	0	0	**0**	**0.0**
20210630	4	10	25	**39**	**5.8**
20210701	3	2	1	**6**	**0.9**
20210702	8	7	5	**20**	**3.0**
20210703	11	0	0	**11**	**1.6**
20210704	48	2	3	**53**	**7.9**
20210705	15	0	0	**15**	**2.2**
20210706	6	0	0	**6**	**0.9**
20210707	1	1	0	**2**	**0.3**
20210708	2	0	0	**2**	**0.3**
Species Total	**98**	**22**	**34**	**154**	
Passes per hour	**1.5**	**0.3**	**0.5**	**2.3**	

T9

	MYODAU	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210629	0	0	121	0	**121**	**17.9**
20210630	0	3	13	0	**16**	**2.4**
20210701	0	1	235	4	**240**	**35.6**
20210702	1	2	406	20	**429**	**63.6**
20210703	0	3	116	3	**122**	**18.1**
20210704	0	6	316	2	**324**	**48.0**
20210705	0	3	438	8	**449**	**66.5**
20210706	0	5	229	13	**247**	**36.6**
20210707	0	3	209	1	**213**	**31.6**
20210708	0	0	143	0	**143**	**21.2**
Species Total	**1**	**26**	**2226**	**51**	**2304**	
Passes per hour	**0.0**	**0.4**	**33.0**	**0.8**	**34.1**	

T10

	MYODAU	NYCLEI	PIPPIP	PIPPYG	**TOTAL**	**BAI**
20210629	0	5	45	20	**70**	**10.4**
20210630	2	6	10	3	**21**	**3.1**
20210701	0	13	23	6	**42**	**6.2**
20210702	0	9	10	3	**22**	**3.3**
20210703	1	3	32	11	**47**	**7.0**
20210704	1	84	79	26	**190**	**28.1**
20210705	2	6	67	86	**161**	**23.9**
20210706	0	3	39	53	**95**	**14.1**
20210707	0	16	58	34	**108**	**16.0**
20210708	0	8	34	4	**46**	**6.8**
Species Total	**6**	**153**	**397**	**246**	**802**	
Passes per hour	**0.1**	**2.3**	**5.9**	**3.6**	**11.9**	

Summer (Late)

T1	MYONAT	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210823	4	2	2	1	**9**	**0.9**
20210824	3	3	13	4	**23**	**2.4**
20210825	2	5	10	16	**33**	**3.5**
20210826	2	4	5	4	**15**	**1.6**
20210827	2	6	10	2	**20**	**2.1**
20210828	0	10	24	9	**43**	**4.5**
20210829	0	2	4	4	**10**	**1.1**
20210830	1	2	0	0	**3**	**0.3**
20210831	0	3	4	2	**9**	**0.9**
20210901	0	4	2	0	**6**	**0.6**
Species Total	**14**	**41**	**74**	**42**	**171**	
Passes per hour	**0.1**	**0.4**	**0.8**	**0.4**	**1.8**	

T4	MYODAU	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210823	1	19	1	0	0	**21**	**2.2**
20210824	0	14	0	0	0	**14**	**1.5**
20210825	0	26	9	1	0	**36**	**3.8**
20210826	0	15	1	3	0	**19**	**2.0**
20210827	0	1	0	0	0	**1**	**0.1**
20210828	0	7	1	0	0	**8**	**0.8**
20210829	0	4	0	0	0	**4**	**0.4**
20210830	0	3	0	0	0	**3**	**0.3**
20210831	0	4	1	0	0	**5**	**0.5**
20210901	0	1	2	1	1	**5**	**0.5**
Species Total	**1**	**94**	**15**	**5**	**1**	**116**	
Passes per hour	**0.0**	**1.0**	**0.2**	**0.1**	**0.0**	**1.2**	

T5 Full Spectrum	MYODAU	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210823	0	3	2	2	5	0	**12**	**1.3**
20210824	0	8	0	9	4	1	**22**	**2.3**
20210825	0	6	0	3	3	3	**15**	**1.6**
20210826	1	2	0	4	2	0	**9**	**0.9**
20210827	2	2	0	2	1	0	**7**	**0.7**
20210828	0	2	0	5	5	0	**12**	**1.3**
20210829	0	4	0	1	3	1	**9**	**0.9**
20210830	0	0	0	0	0	0	**0**	**0.0**
20210831	0	0	0	0	0	0	**0**	**0.0**
20210901	0	0	0	0	0	0	**0**	**0.0**
Species Total	**3**	**27**	**2**	**26**	**23**	**5**	86	
Passes per hour	**0.0**	**0.3**	**0.0**	**0.3**	**0.2**	**0.1**	0.9	

T6	MYODAU	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210823	0	16	2	0	0	**18**	**1.9**
20210824	0	16	1	0	0	**17**	**1.8**
20210825	0	7	15	7	0	**29**	**3.1**
20210826	0	4	1	1	1	**7**	**0.7**
20210827	1	7	2	0	0	**10**	**1.1**
20210828	0	19	5	4	0	**28**	**2.9**
20210829	0	0	3	0	0	**3**	**0.3**
20210830	0	3	0	0	0	**3**	**0.3**
20210831	0	2	0	1	0	**3**	**0.3**
20210901	0	4	3	0	1	**8**	**0.8**
Species Total	**1**	**78**	**32**	**13**	**2**	126	
Passes per hour	**0.0**	**0.8**	**0.3**	**0.1**	**0.0**	1.3	

T7	MYODAU	MYONAT	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210817	0	0	0	0	0	0	**0**	**0.0**
20210818	0	1	7	1	1	0	**10**	**1.1**
20210819	1	0	12	1	3	1	**18**	**1.9**
20210820	0	0	19	1	0	0	**20**	**2.1**
20210821	0	0	0	0	0	0	**0**	**0.0**
20210822	0	0	4	1	0	1	**6**	**0.6**
20210823	0	0	12	3	0	1	**16**	**1.7**
20210824	1	0	6	3	0	3	**13**	**1.4**
20210825	0	0	9	35	15	1	**60**	**6.3**
20210826	1	0	12	1	2	0	**16**	**1.7**
Species Total	**3**	**1**	**81**	**46**	**21**	**7**	**159**	
Passes per hour	**0.0**	**0.0**	**0.9**	**0.5**	**0.2**	**0.1**	**1.7**	

T8	MYODAU	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210817	0	7	0	1	0	0	**8**	**0.8**
20210818	4	8	0	7	4	0	**23**	**2.4**
20210819	3	8	0	1	7	1	**20**	**2.1**
20210820	1	14	0	3	2	0	**20**	**2.1**
20210821	0	1	0	1	1	0	**3**	**0.3**
20210822	1	16	0	58	18	1	**94**	**9.9**
20210823	5	10	0	0	5	0	**20**	**2.1**
20210824	3	9	1	17	26	0	**56**	**5.9**
20210825	0	3	0	1	0	0	**4**	**0.4**
20210826	0	6	0	3	6	0	**15**	**1.6**
Species Total	**17**	**82**	**1**	**92**	**69**	**2**	**263**	
Passes per hour	**0.2**	**0.9**	**0.0**	**1.0**	**0.7**	**0.0**	**2.8**	

T9	MYODAU	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210823	1	35	16	8	0	**60**	**6.3**
20210824	0	26	7	2	0	**35**	**3.7**
20210825	0	33	4	0	0	**37**	**3.9**
20210826	2	44	7	3	0	**56**	**5.9**
20210827	0	53	0	2	0	**55**	**5.8**
20210828	0	50	11	8	1	**70**	**7.4**
20210829	0	29	3	0	1	**33**	**3.5**
20210830	0	13	3	2	0	**18**	**1.9**
20210831	0	14	12	1	1	**28**	**2.9**
20210901	0	10	2	0	0	**12**	**1.3**
Species Total	**3**	**307**	**65**	**26**	**3**	**404**	
Passes per hour	**0.0**	**3.2**	**0.7**	**0.3**	**0.0**	**4.3**	

T10	MYODAU	NYCLEI	PIPNAT	PIPPIP	PIPPYG	TOTAL	BAI
20210817	0	5	0	3	0	**8**	**0.8**
20210818	0	8	0	10	4	**22**	**2.3**
20210819	1	1	0	11	1	**14**	**1.5**
20210820	0	34	0	2	1	**37**	**3.9**
20210821	0	0	0	0	0	**0**	**0.0**
20210822	0	28	0	8	3	**39**	**4.1**
20210823	0	5	0	3	2	**10**	**1.1**
20210824	0	8	1	5	6	**20**	**2.1**
20210825	1	4	0	5	2	**12**	**1.3**
20210826	0	4	0	12	1	**17**	**1.8**
Species Total	**2**	**97**	**1**	**59**	**20**	**179**	
Passes per hour	**0.0**	**1.0**	**0.0**	**0.6**	**0.2**	**1.9**	

T11	MYODAU	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210823	1	18	11	4	1	**35**	**3.7**
20210824	1	5	7	5	0	**18**	**1.9**
20210825	0	2	1	1	0	**4**	**0.4**
20210826	1	12	1	5	2	**21**	**2.2**
20210827	1	9	1	0	4	**15**	**1.6**
20210828	0	15	10	10	0	**35**	**3.7**
20210829	1	12	6	4	0	**23**	**2.4**
20210830	0	4	2	1	0	**7**	**0.7**
20210831	1	7	7	3	1	**19**	**2.0**
20210901	0	1	1	1	0	**3**	**0.3**
Species Total	**6**	**85**	**47**	**34**	**8**	**180**	
Passes per hour	**0.1**	**0.9**	**0.5**	**0.4**	**0.1**	**1.9**	

T12	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210817	0	0	0	**0**	**0.0**
20210818	26	4	0	**30**	**3.2**
20210819	10	9	2	**21**	**2.2**
20210820	7	0	0	**7**	**0.7**
20210821	0	0	0	**0**	**0.0**
20210822	5	0	3	**8**	**0.8**
20210823	12	1	1	**14**	**1.5**
20210824	14	0	3	**17**	**1.8**
20210825	20	16	6	**42**	**4.4**
20210826	10	0	1	**11**	**1.2**
Species Total	**104**	**30**	**16**	**150**	
Passes per hour	**1.1**	**0.3**	**0.2**	**1.6**	

T13	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210817	0	0	0	0	**0**	**0.0**
20210818	0	1	1	0	**2**	**0.2**
20210819	19	0	1	0	**20**	**2.1**
20210820	16	1	0	0	**17**	**1.8**
20210821	0	0	0	0	**0**	**0.0**
20210822	4	3	0	0	**7**	**0.7**
20210823	21	4	1	1	**27**	**2.8**
20210824	10	1	0	1	**12**	**1.3**
20210825	5	18	16	0	**39**	**4.1**
20210826	15	3	0	0	**18**	**1.9**
Species Total	**90**	**31**	**19**	**2**	**142**	
Passes per hour	**0.9**	**0.3**	**0.2**	**0.0**	**1.5**	

Autumn

T1	MYONAT	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210921	0	0	0	0	**0**	**0.0**
20210922	0	0	0	0	**0**	**0.0**
20210923	0	0	0	0	**0**	**0.0**
20210924	1	5	7	2	**15**	**1.3**
20210925	0	8	1	2	**11**	**0.9**
20210926	0	0	0	0	**0**	**0.0**
20210927	0	0	1	0	**1**	**0.1**
20210928	0	0	0	0	**0**	**0.0**
20210929	1	0	0	0	**1**	**0.1**
20210930	0	0	0	0	**0**	**0.0**
Species Total	**2**	**13**	**9**	**4**	**28**	
Passes per hour	**0.02**	**0.11**	**0.08**	**0.03**	**0.23**	

T2	PIPPIP	PIPPYG	TOTAL	BAI
20210921	0	0	**0**	**0.0**
20210922	0	0	**0**	**0.0**
20210923	0	0	**0**	**0.0**
20210924	0	0	**0**	**0.0**
20210925	17	5	**22**	**1.8**
20210926	0	0	**0**	**0.0**
20210927	1	0	**1**	**0.1**
20210928	0	0	**0**	**0.0**
20210929	0	0	**0**	**0.0**
20210930	0	0	**0**	**0.0**
Species Total	**18**	**5**	**23**	
Passes per hour	**0.15**	**0.04**	**0.19**	

T3	MYONAT	NYCLEI	PIPNAT	PIPPIP	TOTAL	BAI
20210921	0	0	0	0	**0**	**0.0**
20210922	0	0	0	0	**0**	**0.0**
20210923	1	0	0	0	**1**	**0.1**
20210924	0	0	0	3	**3**	**0.3**
20210925	1	2	1	5	**9**	**0.8**
20210926	0	0	0	0	**0**	**0.0**
20210927	0	0	0	0	**0**	**0.0**
20210928	0	0	0	0	**0**	**0.0**
20210929	1	0	0	0	**1**	**0.1**
20210930	0	0	0	0	**0**	**0.0**
Species Total	**3**	**2**	**1**	**8**	**14**	
Passes per hour	**0.03**	**0.02**	**0.01**	**0.07**	**0.12**	

T3 (2nd)	MYONAT	PIPPIP	PIPPYG	TOTAL	BAI
20211004	0	0	0	**0**	**0.0**
20211005	0	0	0	**0**	**0.0**
20211006	0	0	0	**0**	**0.0**
20211007	0	0	0	**0**	**0.0**
20211008	0	1	1	**2**	**0.2**
20211009	1	1	0	**2**	**0.2**
20211010	1	7	1	**9**	**0.7**
20211011	0	6	0	**6**	**0.5**
20211012	0	7	1	**8**	**0.6**
20211013	0	1	0	**1**	**0.1**
Species Total	**2**	**23**	**3**	**28**	
Passes per hour	**0.02**	**0.18**	**0.02**	**0.22**	

T4	NYCLEI	PIPNAT	PIPPIP	PIPPYG	TOTAL	BAI
20210921	0	0	0	0	**0**	**0.0**
20210922	0	0	0	0	**0**	**0.0**
20210923	0	0	0	0	**0**	**0.0**
20210924	0	0	2	0	**2**	**0.2**
20210925	5	1	17	1	**24**	**2.0**
20210926	0	0	2	0	**2**	**0.2**
20210927	0	0	0	0	**0**	**0.0**
20210928	0	0	0	0	**0**	**0.0**
20210929	0	0	0	0	**0**	**0.0**
20210930	0	0	0	0	**0**	**0.0**
Species Total	**5**	**1**	**21**	**1**	**28**	
Passes per hour	**0.04**	**0.01**	**0.18**	**0.01**	**0.23**	

T5	PIPPIP	TOTAL	BAI
20210921	2	**2**	**0.2**
20210922	0	**0**	**0.0**
20210923	0	**0**	**0.0**
20210924	2	**2**	**0.2**
20210925	5	**5**	**0.4**
20210926	0	**0**	**0.0**
20210927	0	**0**	**0.0**
20210928	0	**0**	**0.0**
20210929	0	**0**	**0.0**
20210930	0	**0**	**0.0**
Species Total	**9**	**9**	
Passes per hour	**0.08**	**0.08**	

T6	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210921	0	0	0	**0**	**0.0**
20210922	0	0	0	**0**	**0.0**
20210923	0	0	0	**0**	**0.0**
20210924	10	1	0	**11**	**0.9**
20210925	3	6	3	**12**	**1.0**
20210926	0	0	0	**0**	**0.0**
20210927	0	0	0	**0**	**0.0**
20210928	0	0	0	**0**	**0.0**
20210929	0	0	0	**0**	**0.0**
20210930	0	0	0	**0**	**0.0**
Species Total	**13**	**7**	**3**	**23**	
Passes per hour	**0.11**	**0.06**	**0.03**	**0.19**	

T8	NYCLEI	PIPPIP	TOTAL	BAI
20210922	0	0	**0**	**0.0**
20210923	0	0	**0**	**0.0**
20210924	0	1	**1**	**0.1**
20210925	1	0	**1**	**0.1**
20210926	0	0	**0**	**0.0**
20210927	0	0	**0**	**0.0**
20210928	0	0	**0**	**0.0**
20210929	0	0	**0**	**0.0**
20210930	0	0	**0**	**0.0**
20211001	0	0	**0**	**0.0**
Species Total	**1**	**1**	**2**	
Passes per hour	**0.01**	**0.01**	**0.02**	

T9	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210922	0	0	0	**0**	**0.0**
20210923	1	2	0	**3**	**0.3**
20210924	0	8	0	**8**	**0.7**
20210925	7	13	5	**25**	**2.1**
20210926	0	0	0	**0**	**0.0**
20210927	0	0	0	**0**	**0.0**
20210928	0	0	0	**0**	**0.0**
20210929	0	0	0	**0**	**0.0**
20210930	0	0	0	**0**	**0.0**
20211001	0	0	0	**0**	**0.0**
Species Total	**8**	**23**	**5**	**36**	
Passes per hour	**0.07**	**0.19**	**0.04**	**0.30**	

T10 Full Spectrum	MYODAU	MYONAT	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210922	0	0	0	1	0	0	**1**	**0.1**
20210923	0	0	0	5	0	0	**5**	**0.4**
20210924	1	1	1	3	1	1	**8**	**0.7**
20210925	0	0	2	3	0	0	**5**	**0.4**
20210926	0	0	0	1	0	0	**1**	**0.1**
20210927	0	0	0	0	0	0	**0**	**0.0**
20210928	0	0	0	0	0	0	**0**	**0.0**
20210929	0	0	0	0	0	0	**0**	**0.0**
20210930	0	0	0	0	0	0	**0**	**0.0**
20211001	0	0	0	0	0	0	**0**	**0.0**
Species Total	**1**	**1**	**3**	**13**	**1**	**1**	**20**	
Passes per hour	**0.01**	**0.01**	**0.03**	**0.11**	**0.01**	**0.01**	**0.17**	

T11	MYODAU	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210922	0	0	0	0	0	0	**0**	**0.0**
20210923	0	7	0	0	0	0	**7**	**0.6**
20210924	1	15	0	23	1	0	**40**	**3.3**
20210925	0	16	1	24	9	0	**50**	**4.2**
20210926	0	2	0	0	0	0	**2**	**0.2**
20210927	0	0	0	0	0	0	**0**	**0.0**
20210928	0	0	0	1	0	1	**2**	**0.2**
20210929	0	0	0	0	0	0	**0**	**0.0**
20210930	1	2	0	1	0	0	**4**	**0.3**
20211001	0	0	0	0	0	0	**0**	**0.0**
Species Total	**2**	**42**	**1**	**49**	**10**	**1**	**105**	
Passes per hour	**0.02**	**0.35**	**0.01**	**0.41**	**0.08**	**0.01**	**0.88**	

T12	NYCLEI	PIPPIP	PIPPYG	TOTAL	BAI
20210922	0	0	0	**0**	**0.0**
20210923	0	0	0	**0**	**0.0**
20210924	0	0	0	**0**	**0.0**
20210925	1	5	2	**8**	**0.7**
20210926	0	1	0	**1**	**0.1**
20210927	0	0	0	**0**	**0.0**
20210928	0	0	0	**0**	**0.0**
20210929	0	0	0	**0**	**0.0**
20210930	0	0	0	**0**	**0.0**
20211001	0	0	0	**0**	**0.0**
Species Total	**1**	**6**	**2**	**9**	
Passes per hour	**0.01**	**0.05**	**0.02**	**0.08**	

T13	MYONAT	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTAL	BAI
20210922	0	0	0	0	0	**0**	**0.0**
20210923	0	0	0	0	0	**0**	**0.0**
20210924	0	0	0	0	2	**2**	**0.2**
20210925	1	3	9	1	0	**14**	**1.2**
20210926	0	0	1	0	0	**1**	**0.1**
20210927	0	0	0	0	0	**0**	**0.0**
20210928	0	0	0	0	0	**0**	**0.0**
20210929	0	0	0	0	0	**0**	**0.0**
20210930	0	0	0	0	0	**0**	**0.0**
20211001	0	0	0	0	0	**0**	**0.0**
Species Total	**1**	**3**	**10**	**1**	**2**	**17**	
Passes per hour	**0.01**	**0.03**	**0.08**	**0.01**	**0.02**	**0.14**	

Part 2c: Weather Data

Weather Conditions During Deployment Periods

Spring

Weather Data @ 9pm	Temperature °C	Wind Speed m/s	Wind Direction	Rainfall mm
19/05/2021	6	4	NE	0.1
20/05/2021	1	7	WNW	4.4
21/05/2021	8.5	3.6	NE	0
22/05/2021	6.3	1.3	WSW	0
23/05/2021	6.9	1	NW	8
24/05/2021	6.5	4.1	NNW	0
25/05/2021	8.1	2.9	W	0
26/05/2021	8	1.2	SSW	0
27/05/2021	11.1	1	WSW	0
28/05/2021	12.8	0.6	SSE	1.2
29/05/2021	11.7	0.2	NNE	0
30/05/2021	13.8	0.8	NE	0

Summer (Early)

Weather Data @ 9pm	Temperature °C	Wind Speed m/s	Wind Direction	Rainfall mm
29/06/2021	8	4	NE	0.0
30/06/2021	12	3	E	0.0
01/07/2021	7	3	SW	0.0
02/07/2021	13	2	W	0.0
03/07/2021	12	4	SW	0.5
04/07/2021	14	3	SW	4.2
05/07/2021	12	2	SW	0.2
06/07/2021	4	4	NNE	0.4
07/07/2021	13	3	NNE	0.1
08/07/2021	13	1	SE	0.1

Summer (Late)

Weather Data @ 9pm	Temperature °C	Wind Speed m/s	Wind Direction	Rainfall mm
17/08/2021	13	4	NNE	0.0
18/08/2021	12	3	NNE	0.0
19/08/2021	4	3	SW	0.0
20/08/2021	14	8	SW	8.0
21/08/2021	15	3	SSE	1.3
22/08/2021	14	4	NE	0.0
23/08/2021	14	2	NE	0.0
24/08/2021	14	1	NNE	0.0
25/08/2021	15	2	NE	0.0
26/08/2021	15	1	NE	0.1
27/08/2021	13	2	W	0.0
28/08/2021	13	3	NNE	0.0
29/08/2021	13	3	E	0.0
30/08/2021	6	3	NE	0.0
31/08/2021	7	2	NE	0.0
01/09/2021	13	3	ENE	0.0

Autumn

Weather Data @ 9pm	Temperature °C	Wind Speed m/s	Wind Direction	Rainfall mm
21/09/2021	13	4	WNW	0.0
22/09/2021	12	4	NNE	3.6
23/09/2021	13	6	NNW	0.3
24/09/2021	14	4	NW	0.4
25/09/2021	12	4	WSW	0.1
26/09/2021	9	4	NE	9.7
27/09/2021	10	6	WNW	0.1
28/09/2021	8	5	NNE	0.1
29/09/2021	8	5	WSW	16.0
30/09/2021	11	3	NW	10.2
01/10/2021	8	7	NW	0.1
04/10/2021	9	2	WSW	0.4
05/10/2021	10	5	NE	0.0
06/10/2021	12	6	WSW	0.2
07/10/2021	13	6	W	8.0
08/10/2021	14	5	W	11.4
09/10/2021	14	2	NE	0.2
10/10/2021	10	5	NNE	0.0
11/10/2021	11	5	N	0.0
12/10/2021	12	3	NNE	0.0
13/10/2021	12	3	NNW	0.0

Part 2d: NIEA Licence Return (Endoscopic Survey)

License Return

License to Disturb Bats through use of Endoscope

This report summaries the findings of a site visit carried out on the 22nd October 2021 and provides evidence of the successful implementation of the methodology which was agreed as part of the NIEA Wildlife License application.

The site was located on the Ballymena Rd (A42), Carnlough and consisted of a small area of broad-leaved woodland. An initial site walkover identified three trees with moderate bat roost potential.

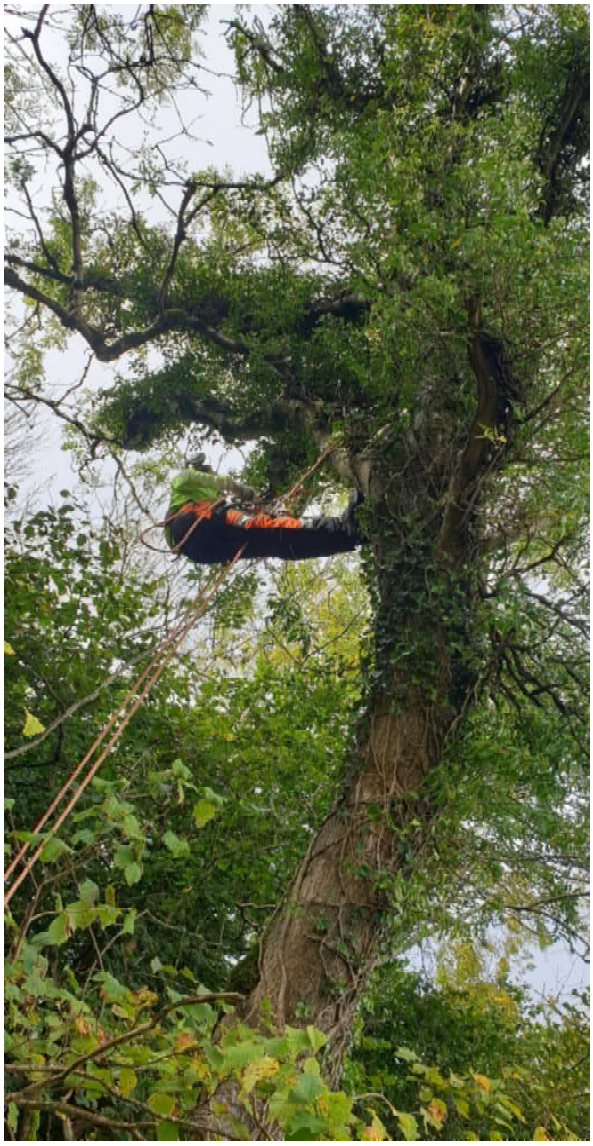
Upon arriving at the site, the works were discussed with the tree climbing technician and each tree was to be inspected using the necessary tree rigging equipment. The ecologist would observe from below with monitoring device in-hand should an endoscope be required.

Each tree was surveyed at height for cracks and crevices that had potential for roosting bats. Two of the three trees contained no cracks or crevices which required the use of an endoscope. The third tree contained one area of interest which was inspected using the endoscope but the crevice was too shallow and no bats or evidence of bat roosts were found.

Results

No bats or evidence of bat roosts were found with each tree that was inspected.

The photos below provide evidence of the works that took place.



Part 3: Non-volant Mammal Report

Contents

Executive Summary

This is a brief summary of survey results for red squirrels *Sciurus vulgaris*, pine martens *Martes martes* and badgers *Meles meles*. For full details please read the report in its entirety.

- Blackstaff Ecology Ltd was appointed by RES UK and Ireland to conduct the necessary ecological surveys for a proposed wind farm, located in the vicinity of Unshinagh Mountain Townland (Irish Grid Ref: D 25268 13768).

- Survey constraints prevent full mammal surveys being conducted within the forest areas to the south of the site. Instead, x4 baited camera traps were deployed in various locations within these conifer plantation areas (deployed 21st January 2021, collected 8th April 2021 / 3rd November 2021). Additionally, a full badger survey was conducted along proposed infrastructure routes.

- During the construction period, an ECoW should be appointed to maintain a watching brief for forest areas 1-4 to the South of the site and instruct appropriate mitigation should evidence of squirrel, pine marten or badger presence arise.

- In all instances an emergency procedure will be communicated to site workers detailing what to do if signs of red squirrel, pine marten or badgers are encountered.

Red Squirrels

- Red squirrels were sighted within the surrounding landscape however this was outside the site boundary. No squirrels were sighted or recorded within the site boundary.

- Red squirrels are not considered present. However, they may colonise the plantations in the future as the trees reach an age that they produce sufficient cones for food.

- Further baited camera traps should be deployed in lieu of pre-felling surveys, due to survey constraints preventing thorough survey effort of the forest areas, to confirm continued squirrel absence prior to works beginning. These should be deployed for 3-5 days no more than 3 weeks before works begin.

Pine Martens

- Pine martens are present in the coniferous forestry to be felled (confirmed through camera trap footage).

- Mitigation for this species is required: 5 artificial den boxes should be erected prior to felling the plantations. Exact locations will be agreed with the ECoW.

Badgers

- Minimal evidence of badger presence was found and no badger setts were identified during the surveys.

- Badger presence (in the coniferous forestry plantation though which the access track will be constructed) was confirmed through camera trap footage.

- This area is likely to be unsuitable for badger setts (due the wet boggy conditions); however, badgers are considered to instead be using the area during foraging activity.

- Should more than 12 months elapse between current surveys and beginning of construction, pre-construction surveys should be undertaken for this species to confirm badger setts remain absent along proposed infrastructure routes.

Methodology

Red squirrels / Pine martens

1. Dedicated walkover surveys were not conducted along proposed infrastructure locations for red squirrels or pine martens. As access was impeded due to the wet boggy conditions, dense network of drainage channels and low hanging branches (due to the relatively young age of the trees, circa 20 years old) transects were not considered practical. Baited camera traps were deemed the most appropriate survey method to determine species presence / absence.

2. Four number baited (squirrel feeders were positioned opposite the cameras and filled with nuts and seeds) camera traps were deployed at various locations within the conifer plantation located to the South of the site (see Figure 6.7). Cameras were deployed on the 21st January 2021 and collected on the 8th April 2021 - with the exception of Camera 3, which was collected later on the 3rd November 2021. All footage was later extracted and assessed for mammal presence.

3. Tree age of the Sitka spruce plantation areas was calculated by cross-referencing trunk circumference with a normal average girth growth rate expectancy for this individual species. Trunk circumference was estimated from DBH (diameter at breast height), approximately 1m above ground level. However, trees growing in higher elevation sites tend to have inferior stem form compared with those planted in more sheltered areas (Hubert et al, 2003). Therefore, the age can be considered slightly higher than that calculated.

Badgers

4. The search area was subject to initial walkover badger surveys on 15th Jan and 24th February 2021 which focused on the proposed x14 turbine locations. Follow-up badger surveys were conducted on 3rd and 4th November 2021 for the proposed tracks and further associated infrastructure. As part of a wider survey effort for red squirrels *Sciurus vulgaris* and pine martens *Martes martes*, x4 Bushnell trail cameras were deployed on the 21st January 2021 at various locations in the conifer plantations located to the Southern end of the site (see Figure 6.7).

5. The search area encompassed the location of the proposed infrastructure (wind turbines, crane hardstanding areas, tracks and temporary construction compounds), as well as a minimum 25m buffer area surrounding this. The search area was thoroughly surveyed for evidence of badgers in the form of:

    - Faeces: badgers deposit faeces in characteristic excavated pits, concentrations of which (latrine sites) are typically found at home range boundaries
    - Setts, comprising either single isolated holes or a series of holes, likely to be interconnected underground
    - Trails - paths between setts or leading to feeding areas
    - Scratching posts at the base of tree trunks
    - Snuffle holes (small scrapes where badgers have searched for insects, earthworms and plant tubers)
    - Day nests (bundles of grass and other vegetation where badgers may sleep above ground)
    - Hair traces
    - Footprints

6. It was intended that, if found, mammal trails be followed to ensure that all setts could be located and linkages to other setts and important foraging areas could be identified.

7. It was intended that all instances of badger activity be target noted with GPS locations.

8. Holes were classified as having been used/dug by a badger if they met the following criteria:
   - ≥25cm in diameter;
   - Rounded or flattened oval in shape;
   - Broader than tall.

9. A series of holes were classified as a single sett if they seemed to be/could be connected underground.

10. It was also intended that evidence for the use of holes by foxes (distinctive fox odour, prey remains, paw prints) or rabbits (droppings, rabbit fur) would be recorded.

11. The standard survey methodology of Harris, Cresswell and Jeffries (1989) was followed; the number of sett entrances and evidence of the current activity of each sett entrance hole was recorded, to facilitate classification of the sett. Sett classification criteria are laid out in Table 1 below.

Table 1 – Badger sett classification

Sett Type	Definition
Main	Several holes with large spoil heaps and obvious paths emanating from and between sett entrances.
Annex	Normally less than 150m from main sett, comprising several holes. May not be in use all the time, even if main sett is very active.
Subsidiary	Usually at least 50m from main sett with no obvious paths connecting to other setts. May only be used intermittently.
Outlier	Little spoil outside holes. No obvious paths connecting to other setts and only used sporadically. May be used by foxes and rabbits.
Disused	No spoil, no paths, absence of bedding. All entrances completely blocked with considerable amount of excavation required for reoccupation.

Survey Constraints

12. Meteorological conditions were favourable. Livestock was present across much of the site, however surveyors remained able to gain immediate access to badger survey areas along infrastructure routes. A robust survey of the areas under coniferous forestry plantation was not possible due to physical access issues caused by dense low-lying branches, drains, wet ground conditions and poor visibility once inside the forest.

13. Baited camera traps were therefore considered the most appropriate survey method to gauge mammal presence / absence. Cameras functioned without technical issues and the images / recordings produced combined with an assessment of the surrounding habitat are considered enough to design appropriate mitigation for the aforementioned species regarding the proposed construction works.

Results

Red squirrels

14. No evidence of red squirrels was found across the site.

15. Red squirrels were sighted in the surrounding landscape: however, this was a treeline outside the red line boundary (within neighbouring land under the applicant's control) see Figure 6.7.

16. No red squirrels were recorded on the trail cameras deployed within the conifer plantations to the South of the site.

Pine martens

17. Pine marten were found to be using the forestry plantations during the camera trapping sessions.

Badgers

18. Minimal evidence of badgers was found across the site.

19. No badger setts were identified during any of the badger walkover survey visits.

20. Badger presence was confirmed in the conifer plantations located to the South of the site by trail camera footage. Evidence including snuffle holes was also recorded here.

21. Trail camera footage confirmed badger presence in only one of the conifer plantations (Block B on Figure 6.10). Badgers were here recorded both within the main forest area and also within a small section of trees set apart from the forest's Southern boundary (see Appendix 2 – Camera Trap Photos).

22. A single fox print was found along the track route north of the small isolated plantation (see Figure 6.7) Foxes were also identified from camera trap footage and are therefore likely to be ubiquitous across much of the area. It is possible some mammal field sigs (i.e. such as trails / push-throughs are the result of fox activity).

23. Target notes (TN) are presented in Table 1.

Table 1 – Target notes, with locations and descriptions. Photos of target notes provided in Appendix 1.

TN	Location (ITM)	Description
1	724804, 913040	Snuffle holes around partially eaten mushrooms.
2	724805, 913060	Possible snuffle marks.
3	724794, 913073	Snuffle marks.
4	724768, 913031	Possible day bed.
5	724819, 913036	Large mammal trails / possible badger latrine / push-through under wire fence leading into forestry.
6	725090, 914474	Fox print preserved in mud.

Evaluation

Red Squirrels

24. No evidence was found to indicate that red squirrels are using the site and no red squirrel dreys were located within 25m of any proposed infrastructure.

25. With the exception of the forest plantations to the South, the remainder of the site constitutes a continuous swath of open ground. There is one additional small isolated patch of conifer trees surrounded by an otherwise open landscape and it is considered unlikely red squirrel are present across the remainder of the site. This is due to the open landscape and lack of tree cover / foraging potential. Red squirrels spend approximately 67% of their time in the canopy throughout the year

and tend to avoid crossing open areas (Kenward and Tonkin, 1986): therefore, should red squirrels colonise the site in the future, this would likely be restricted to the blocks of coniferous plantation forestry.

26. The conifer plantations present on the site could provide suitable drey habitat for red squirrels. However, conifers do not produce a good seed crop until they are at least 15 years old and will not reach maximum production until at least 30 years old (Gordon & Faulkner, 1992).

27. The forests were planted over a circa 3-year period between 1999 and 2001. The trees are mainly Sitka spruce with some lodgepole pine trees on the areas over shallow peat. The edges of each plantation have some native broadleaves planted. Therefore the plantations have only recently become suitable for use by red squirrel.

28. In addition to this, pine marten presence is confirmed within forest plantation areas 1-3, a known predator of the red squirrel. It can be assumed pine martens are present within all forest areas to the south. Recent research has shown that the presence of pine marten increases red squirrel occurrence across the landscape, especially in native broadleaf woodlands. This is because the pine marten suppresses the grey squirrel regardless of habitat. However, this effect is reversed in blocks of non-native conifer plantations, where the pine marten reduces the occurrence of red squirrel. This could be due to the lack of alternate prey, and the lack of refuges for red squirrels in highly simplified landscapes[1].

29. It should be noted that Cleggan Forest is present ~2km West of these conifer plantation areas, measuring ~1129ha which provides a significant amount of alternative habitat in the surrounding landscape. Felling the conifer plantation areas to the South of the site is therefore not expected to constitute significant loss of habitat for the local red squirrel population.

Pine Martens

30. Pine martens have large territories and can roam several miles each night: due to the close proximity of the plantation areas and potential for movement between each, it should be assumed pine martens and their dens are potentially present within the areas of coniferous forestry plantation (when enacting mitigation for this species).

31. Cleggan Forest is present ~2km West of these conifer plantation areas, measuring ~1129ha. The plantation areas to be felled present total ~25.9ha. Due to this significant amount of alternative and more preferable habitat present within the surrounding landscape, any impacts of felling / construction are therefore likely to be significant only at a small localised population level for this species. Although pine martens are present in the Southern Forest areas, these monoculture stands of plantation conifer are not considered particularly valuable habitat: preferred habitat instead being diverse mature woodland with a well-developed ground and shrub layer. These close-canopied immature forest stands lack dense ground flora and vertical or horizontal diversity unsuitable for pine marten which are likely to use it either reluctantly or at low densities.

32. Loss of existing and potential den sites present within the forest areas is the most significant concern to this species. The construction period may have significant disturbance impacts on pine martens, however the post-development phase for wind-energy developments generally presents minimal disturbance for resident pine martens.

[1] Twining Joshua P., Sutherland Chris, Reid Neil and Tosh David G. (2022) Habitat mediates coevolved but not novel species interactions; Proc. R. Soc. B.2892021233820212338

Badgers

33. No evidence was found to indicate that badgers are using the site along proposed infrastructure routes and no badger setts were located within 25m of any proposed infrastructure.

34. Badger presence was confirmed during camera trapping (see Figure 6.7). The sighting was located to the South of the site; with this evidence supported by possible snuffle holes and latrine, found during the 03 November 2021 walkover survey. These signs were located outside the 25m buffer zone of the proposed track cutting through this forest area but within the forest area to be felled / within 25m of the forest edge.

35. The conifer plantations present on site, although providing foraging opportunities, are considered unsuitable habitat for permanent badger presence due to inappropriate soil conditions. This is due to much of the forest plots being planted atop deep peat - terrain here is therefore considered too wet for badger setts. Topography within the plantations is relatively uniform, lacking slopes or earth banks that could provide better drained or more preferable parts of the ground more suitable for digging.

36. The surrounding landscape to the Southern end of the site consists mostly of agricultural land and provides alternative foraging opportunities for badgers through improved pasture and associated agricultural boundaries, namely hedgerows and scrub cover. More preferential habitat for permanent badger presence is likely to exist in the surrounding landscape which would provide more suitable terrain. This also exists elsewhere on the site outside the 25m buffer zone of proposed works, in dryer grassland areas.

Mitigation

Red Squirrels

37. As red squirrels are not considered to be present within the forest areas, felling is clear to take place without mitigation for this species. However, pre-felling surveys should take place to confirm continued red squirrel absence. As the plantation areas are not suitable for a robust walkover survey, in lieu of this baited camera traps should instead again be deployed at various locations within each forest area. These should be deployed a minimum of 6 weeks before start of works.

38. During the construction period, an Ecological Clerk of Works (ECoW) shall be appointed to maintain a watching brief for operations pertaining to the conifer plantation areas to the South. This will be done in tandem with monitoring for signs for pine marten and badger which are similarly protected under the Wildlife (NI) Order.

39. Any evidence of squirrel activity including dreys or foraging signs e.g. stripped tree buds or cones will be recorded using hand-held GPS. These locations will be transferred to GIS for the production of accurate OS-based mapping to assist the development of the scheme felling plan.

40. Any potential dreys found will be assessed by an experienced ecologist for their likely level of use and the trees identified with a numbered high visibility tape to permit easy identification at a later date for further study/monitoring purposes. Collapsed structures will be considered no longer in use and all places of shelter deemed abandoned or defunct will not be subject to mitigation restrictions. Any dreys found will be assumed to be red squirrel unless definitive evidence is provided to prove they belong to grey squirrel.

41. To determine if a drey is being used or not during the breeding season, ground-based day-time

visual observations coupled with trail camera surveillance (over 3-5 days) will be the default methodology. The ECoW will determine if this methodology is suitable for the location: this may not be the case for example in denser areas of forest. If this methodology is considered unsuitable then a physical inspection of the drey will be conducted to confirm presence or absence of young squirrels – this must be done under licence.

42. Should red squirrels or their dreys be sighted during construction, all works should cease immediately and appropriate mitigation designed. This will include a protection zone (minimum 25m during February – September) marked by the ECoW. Any tree-felling taking place outside this zone will ensure, where possible, that a tree corridor is retained to avoid confining any squirrels present in an isolated patch. Any works which would disturb / destroy a drey must first receive a licence to do so. No works should be completed within 25m of dreys being used as breeding sites until the ECoW has confirmed dependent young are no longer present.

Pine Martens

43. Best practice would suggest pre-construction / pre-felling surveys to locate pine marten dens within each plantation block. This would require all forestry to be felled to be fully searched including a 25m buffer zone. This is not possible due to physical survey constraints and likewise not considered the most appropriate methodology for a site of this geographical size: currently the plantation areas combined total ~25.9ha.

44. In lieu of this, as pine marten presence has been confirmed, appropriate mitigation should be designed and enacted. This is as follows:

45. Prior to operations, replacement den boxes will be erected within wooded areas to be retained. This constitutes an area of ~3.2ha located at the South-Eastern edge of the Site (all other forestry present is set to be felled). Five number den boxes should be erected. These should be secured on mature trees approximately 4m from ground level. The artificial dens should be monitored twice a year: this should be done with close-focused binoculars from a distance of 20m which will avoid both need to obtain a licence and disturbance leading to desertion of the den. Indicators that the den is in use include pine marten scat on the lid of the box or tree base.

46. An Ecological Clerk of Works will be appointed to maintain a watching brief during construction and felling operations for the conifer areas to the South, specifically to check for pine marten dens. This will be done in tandem with monitoring for signs for red squirrel and badger which are similarly protected under the Wildlife (NI) Order. This will avoid additional survey effort.

47. An emergency procedure will be communicated to site workers detailing what to do if signs of pine marten (e.g. dens, sightings of animals) are encountered. Should pine martens or their dens be sighted during construction, all works (including those within a 25m buffer) should cease immediately. the Ecological Clerk of Works will inspect the site and define appropriate mitigation (if required). This could involve retaining a small section of forest as a protection zone, to avoid removing / disturbing the den, and similarly retaining a tree corridor through the works areas to avoid confining any present pine martens in an isolated patch.

48. Where potentially occupied places of shelter are identified during operations, the den structures will be recorded using hand-held GPS. These locations will be transferred to GIS for the production of accurate OS-based mapping to assist the development of the scheme felling plan.

49. Any potential dens found will be assessed by an experienced ecologist for their likely level of use and the trees identified with a numbered high visibility tape to permit easy identification at a later

date for further study/monitoring purposes.

Badgers

50. Badgers are considered to be using the forest areas for foraging purposes but no setts are present. Physical survey constraints prevent a badger survey from being conducted for the forest areas however the ground level habitat within the plantation areas is considered unsuitable for badger setts due to the layer of deep peat, making the soil too wet for badgers to create a sufficient tunnel network. Felling is therefore clear to take place without specific mitigation for this species.

51. To give confidence in continued badger sett absence, pre-construction surveys should be conducted for this species specifically along proposed infrastructure locations / routes. These should follow the aforementioned methodology of Harris, Cresswell and Jeffries (1989) as adopted in the walkover surveys.

52. During the construction period, an Ecological Clerk of Works (ECoW) shall be appointed to maintain a watching brief for operations pertaining to the conifer plantation areas to the South. This will be done in tandem with monitoring for signs for pine marten and red squirrel which are similarly protected under the Wildlife (NI) Order.

53. An emergency procedure will be communicated to site workers detailing what to do if badger setts are encountered. Should badgers or their setts be sighted during construction, all works (including those within a 25m buffer, or 100m for operations of high noise / vibration levels) should cease immediately. The Ecological Clerk of Works will inspect the site and define appropriate mitigation (if required). This could involve creating a BPZ (badger protection zone) and timing restrictions on works e.g. construction activities must occur only within daylight hours.

54. Development should not fragment key foraging habitats for badgers; due to the isolated location of the site and minimal human disturbance, it is anticipated that badgers will remain free to roam across the site following the proposed works therefore no mitigation / compensation is here needed.

55. It should be noted that badgers are a mobile species and can excavate setts at any time. Should badger activity become apparent within the site prior to or during construction then all works should cease and NIEA should be immediately informed.

Conclusions

Red Squirrels

56. Red squirrels are not considered present within the site boundary, however were sighted in the surrounding landscape.

57. Mitigation is only considered necessary should red squirrel presence be confirmed in camera trap footage in the 3 week period before works begin, or during works.

Pine Martens

58. Pine marten are present on site and mitigation is necessary.

Badgers

59. Badgers, although foraging within the forest areas, are not considered able to construct setts in this habitat.

60. Mitigation is only considered necessary should badger setts be discovered during preconstruction surveys/construction works.

References

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NIEA (2017) *Badger Surveys NIEA Specific Requirements*

NIEA (2011) *Badgers and Development*

Vincent Wildlife Trust (2020) A guide to identifying evidence of pine martens

Vincent Wildlife Trust (2015) Constructing, erecting and monitoring Pine Marten den boxes

Appendix 1 – Camera Trap Pictures

Camera Trap 1

Photo 1 - Badger

Photo 2 – Pine marten

Camera Trap 2

Photo 3 – Fox

Photo 4 – Pine marten

Camera Trap 3

Photo 5 – Pine marten

Camera Trap 4

Photo 6 – Fox

Photo 7 – Badger

Appendix 2 – Mammal Survey Target Note Photos

TN 1
Photo 1

TN 2
Photo 2

TN 3
Photo 3

TN 4
Photo 4

TN 5
Photo 5

Photo 6

Photo 7

TN 6

Photo 8

Part 4a: Smooth Newt Report

Executive Summary

This is a brief summary of survey results. For full details please read the report in its entirety.

- Smooth newt surveys were conducted by Blackstaff Ecology Ltd at the proposed Unshinagh wind farm during the 2021 survey season.

- Several ponds supporting smooth newt populations were identified within the boundaries of the proposed project. Mitigation specific to this species will therefore be required.

Introduction

1. Surveys were conducted under a licence issued by NIEA under the terms of Article 18 (1)(a) of the Wildlife (NI) Order 1985 or Article 39 (2)(a) of the conservation (Natural Habitats, etc.) Regulations (NI) 1995, valid until 15 June 2021.

Statement of Authority

2. Field surveys were conducted by Traci Adams MSc, BSc (Hons), Dr Erfan Fadaei BSc (Hons) Philip Leathem, Michelle Duggan MSc BSc (Hons) and Catriona Porter MSc BSc (Hons). This report was prepared by Traci, review by Dr Erfan Fadaei and approved by Cormac Loughran MSc CEnv MCIEEM.

Methodology

3.1. Habitat Suitability Index Assessments

3. Walkover surveys were conducted at the site in order to identify water bodies and assess their suitability for breeding smooth newt.

4. The potential for newts to be present in a particular pond increases when the waterbody holds certain characteristics (Oldham et al., 2000). These characteristics include:

- S1 - Geographic location – lowland areas are more likely to support newts
- S2 - A large pond surface area – the suitability of a pond for newts increases with its surface areas until 800m2, after which the suitability begins to decline again, but remains higher than that of ponds smaller than 400m2 in surface area.
- § S3 - Pond permanence – the less likely a pond is to dry out, the more likely newts are to be present.
- S4 - High water quality – an abundant and diverse invertebrate community, as well abundant submerged plants are indicators of good water quality. The higher the water quality, the more likely newts are to be present.
- S5 - Shade – a high level of shade at the edge of the water body is most preferable
- § S6 - Absence of waterfowl – waterfowl reduce habitat quality of a pond for newts by removing vegetation, polluting the water and even predating the newts. Therefore, if waterfowl are absent or are low in number, this increases the likelihood that newts are present.
- S7 - Absence of fish – fish can predate upon newt larvae. Therefore, if fish are low in number, newts are more likely to be present.
- § S8 - A high pond count – the higher the number of ponds within a 1 km radius of the pond in question, the higher the likelihood that newts might have dispersed to the area.
- S9 - Terrestrial habitat – A water body surrounded by suitable newt habitat offering cover and foraging opportunities is more likely to support newts.

- S10 - Macrophyte cover – The higher the percentage of macrophyte cover (up to 80%), the higher the suitability of the pond for newts. Macrophytes provide them with shelter and habitat for females to lay eggs. When macrophyte cover increases above 80%, suitability begins to decline, but remains high.

5. The Habitat Suitability Index (HSI) for each water was calculated following the methodology presented in ARG UK Great Crested Newt Habitat Suitability Index (2010) document.

6. The HSI is a geometric mean of ten suitability indices (SI) and is calculated as follows:

$$HSI = (SI1 \times SI2 \times SI3 \times SI4 \times SI5 \times SI6 \times SI7 \times SI8 \times SI9 \times SI10)1/10$$

7. Where the HSI was above 0.5, waterbodies were deemed suitable to support smooth newt and included for torchlight survey.

Field survey

8. NIEA's Specific Requirements in relation to Newt Surveys and English Natures' (now Natural England) 'Great Crested Newt Mitigation Guidelines' were considered while carrying out the field surveys. Although the latter were designed with specific focus on Great crested newts, certain aspects of the survey methodology and mitigation they present are considered applicable to smooth newts.

9. Torchlight survey methodology was employed during all site visits to ascertain smooth new presence/absence and population size class.

10. Each survey was conducted throughout the period of mid-May to early June, during suitable weather conditions (no rain, temperature >5°C and little or no wind). All surveys began at least 30 minutes post sunset and each pond was surveyed for one hour.

11. According to the Great Crested Newt Mitigation Guidelines, the maximum adult count per pond per night gained through torch survey should be quoted as the main figure.

12. Populations can then be classed as:
    - 'small' for maximum counts up to 10,
    - 'medium' for maximum counts between 11 and 100,
    - 'large' for maximum counts over 100.

13. This method is in accordance with that for providing a 'Population Count' of Sewell et al. (2012). They state that a population count aims to give an idea of the relative abundance of species by using its peak count and use the same classing system.

Survey constraints

14. There were no significant constraints to survey during any of the site visits. The timing of each of the three surveys was ideal for detecting the presence of Smooth Newt during the breeding (aquatic) phase of its annual life cycle. As such, the data presented here is considered to be a robust assessment of the smooth newt population in this area.

Results

Habitat Suitability Indices

15. Initial walkover surveys identified 27 water bodies within the site boundary; 25 of these were assessed to have HSI values above 0.5. The latter were therefore subject to torchlight surveys.

Torchlight Survey Weather Conditions

16. Table 1 below summarises the weather during each of the visits.

Table 1: Weather conditions during each of the Smooth Newt Surveys.

Survey visit	Date	Sunset	Temperature (°C)	Rain	Wind (mph)
1	23/03/2021	18:44	6 – 9	No	10 - 11
2	31/03/2021	19:59	8	No	11 – 12
3	21/04/2021	20:39	6 – 8	No	6
4	25/05/2021	21:42	9	No	10
5	09/06/2021	22:00	14 – 16	No	9 - 10

Newt Survey Results

17. Table 2 below summarises the new survey results for the 25 ponds subject to torchlight surveys.

18. Additional visits were not conducted at ponds which were found to be dry during the 1st or 2nd visits.

19. Ponds 12 and 19 were not included in the torchlight surveys, as they had HSI values below 0.5.

Pond	Visit		
	1	2	3
1	No newts 23/03/2021	Pond Dry 09/06/2021	N/A
2	No newts 23/03/2021	Dry 09/06/2021	N/A
3	No newts 23/03/2021	Dry 09/06/2021	N/A
4	No newts 21/04/2021	No newts 25/05/2021	 09/06/2021
5	1 Newt 21/04/2021	No newts 25/05/2021	 09/06/2021
6	No newts 21/04/2021	No newts 25/05/2021	 09/06/2021
7	No newts 21/04/2021	No newts 25/05/2021	 09/06/2021
8	No newts 21/04/2021	No newts 25/05/2021	 09/06/2021
9	No newts 21/04/2021	No newts 25/05/2021	 09/06/2021
10	No newts 21/04/2021	7 newts 25/05/2021	 09/06/2021

11	7 newts	22 newts	
	21/04/2021	25/05/2021	09/06/2021
12	Pond HSI below 0.5		
13	No newts	No newts	
	31/03/2021	25/05/2021	09/06/2021
14	No newts	No newts	
	31/03/2021	25/05/2021	09/06/2021
15	No newts	No newts	
	31/03/2021	25/05/2021	09/06/2021
16	No newts	No newts	
	31/03/2021	25/05/2021	09/06/2021
17	Dry	Dry	Dry
	31/03/2021	25/05/2021	09/06/2021
18	9 newts	7 newts	35 newts
	31/03/2021	25/05/2021	09/06/2021
19	Pond HIS below 0.5		
20	3 newts	1 newt	3 newts
	21/04/2021	25/05/2021	09/06/2021
21	No newts	Dry	N/A
	23/03/2021	09/06/2021	
22	No newts	Dry	N/A
	23/03/2021	09/06/2021	
23	No newts	Dry	N/A
	23/03/2021	09/06/2021	
24	No newts	Dry	N/A
	23/03/2021	09/06/2021	
25	No newts	Dry	N/A
	23/03/2021	09/06/2021	
26	No newts	6 newts	N/A
	23/03/2021	09/06/2021	
27	No newts	Cattle in field – pond not surveyed	N/A
	23/03/2021	09/06/2021	

Summary

20. Newts were recorded at ponds: 5, 10, 11, 18, 20 and 26.

21. Ponds 5, 10, 20 and 26 had maximum counts of below 10 individuals and therefore are considered to support small smooth newt populations.

22. Ponds 11 and 18 had maximum counts of 22 and 35 respectively and are therefore considered to support medium sized populations of smooth newt.

Evaluation

23. Please note that all conclusions and recommendations are based only upon the findings of the surveys referred to therein.

24. Changes to site management can alter the use of the site by Smooth Newt; this species can also be highly mobile, which may necessitate future re-surveying of the site.

25. Newts were identified in several of the ponds present on site. Mitigation to avoid harmful impacts to this species will therefore be required.

26. Note that NIEA may place restrictions on the timing and methodology of any works affecting newt habitat.

References

- English Nature (2001). Great Crested Newt Mitigation Guidelines. English Nature, Peterborough.
- Northern Ireland Environment Agency (2017). Newt Surveys: NIEA Specific Requirements, 17th February 2017. www.daera-ni.gov.uk/sites/default/files/publications/daera/newt-survey-specifications.pdf

Part 4b: Common Lizard Report

Executive Summary

This is a brief summary of survey results. For full details please read the report in its entirety.

- Common lizards *Zootoca vivipara*, were found to be present on the proposed development site and were assessed as being of low density.

- A mitigation plan has been proposed to negate potential adverse impacts of the proposed development on the local common lizard population.

Introduction

1. Blackstaff Ecology Ltd was appointed by RES UK and Ireland Ltd to conduct ecological surveys to inform the EcIA (Ecological Impact Assessment) for the proposed Unshinagh windfarm, including surveys for common lizard (*Zootoca vivipara*).

2. The location of the site and habitat present suggested that there was the potential for common lizards and smooth newt to be present on the site or in the immediate environs surrounding.

3. The purpose of the survey was to ascertain whether common lizards were present within the boundary of the application site and, if present, to determine the distribution and density of each species. This information will identify the potential for the proposed installation to have adverse impacts upon the local reptile population and inform any mitigation measures required.

4. Common lizard is a protected species in Northern Ireland, and are therefore protected from being killed, injured or taken. If this species is present on site, then measures must be taken to protect them from any potential negative impacts of the development.

5. The construction phase of a wind farm installation has the potential to negatively impact on the local reptile population via disturbance and the removal of habitat. However, if suitable mitigation measures are implemented and carried out effectively, the impact of this project on the species in question is likely to be not significant.

Statement of Authority

6. Field surveys for common lizard were conducted by Philip Leathem and Cormac Loughran. This report was also prepared by Cormac Loughran CEnv MCIEEM MSc.

Methodology

Common Lizard

7. A common lizard survey was undertaken in accordance with the NIEA survey specifications (NIEA 2017[1]) in order to establish the presence of common lizard within the survey site.

8. In addition to the NIEA methodology, consideration was also given to the Draft survey protocols for the British herpetofauna. The latter document references (Sewell et al. 2012) who recommend that at least 30 artificial refugia should be deployed to determine for presence or absence. This number is not dependent on of the size of site, as long as the refugia are positioned appropriately.

9. Therefore, 30 artificial refugia were deployed were also placed around suitable parts of the site which could be safely accessed (see Figure 6.8 - Common Lizard Survey Results). The transect also took account of suitable habitat within or adjacent to the construction corridor. The following was applied to the emplacement of refugia;

    a. Choose sunny locations away from public view and livestock;

[1] https://www.daera-ni.gov.uk/publications/common-lizard-surveys-specifications

b. Press refugia down close to the ground;

c. Use deep cover or edge of dense vegetation;

d. Do not deploy on bare ground/sparse cover;

e. Lift and replace refugia carefully taking care not to squash retreating animals.

10. Surveys were carried out during suitable weather conditions (as above), and focussed during May & September. The surveys were 2-3 hours in duration and three visits were made (with the first visit at least a week after the refugia were laid).

11. The surveyor incorporated transects by walking slowly and scanning the ground 3-4 m in front for the presence of basking lizards when travelling between artificial refugia.

Results

Common Lizard

Table 1 - Dates, Times, Meteorological Conditions and Results of the Common Lizard Surveys

Date/Time	Weather	Results
21/05/21	14°C sunny and calm	4 (all 4 recorded from refugia)
31/05/21	13°C Some cloud but mostly clear, intermittent light showers and sunny spells	5 (4 recorded from refugia; 1 recorded along the walked transect)
22/09/21	14°C Some cloud but mostly clear and sunny spells	4 (all 4 recorded from refugia)

Discussion

12. A (probable) total of 5 common lizards were recorded using a total of 7 refugia.

13. Populations can then be classed as:
    - 'small' for maximum counts up to 10,
    - 'medium' for maximum counts between 11 and 100,
    - 'large' for maximum counts over 100.

14. This method is in accordance with that for providing a 'Population Count' of Sewell et al. (2012). They state that a population count aims to give an idea of the relative abundance of species by using its peak count and use the same classing system.

15. A maximum total of 5 adult lizards were recorded using a total of seven refugia (see Figure 6.8). The results

of the common lizard surveys reveal a population score of 1 (low population2) (with 7 individuals recorded). It is likely that the habitats surrounding T7 as well as adjacent to T12 and T13 are also potentially good habitat for this species. Albeit, optimal habitat that is degraded via overgrazing. Whereas the habitats surrounding T1, T2 & T4 and possibly T6 may also be suitable habitat for this species. sub-optimal (due to heavy sheep grazing) but that lizards are likely to be present (at low population densities).

Mitigation

16. In the case of common lizard, it has been impossible to totally avoid impacts to this species, given the layout constraints. Therefore, the next course of action is to mitigate for any potential impacts.

17. The results of the common lizard surveys for the Development were assessed against the Key Reptile Site Survey Assessment Categories (HGBI 1998). This revealed that parts of the Site had a low population (with five individuals recorded). However, given the location of the records, it is also likely that much of the site is sub-optimal habitat for this species. This is likely a consequence of over-grazing.

18. Depending on the commencement of construction on site, the works corridor will be mowed. If possible, this work will be undertaken before the end February (to avoid a conflict with the bird breeding season). If this is not possible, then mowing will take place between August and September, when common lizards are likely to be fully active. Should the latter be required, the corridor will be subjected to an active nest survey by a suitably qualified ornithologist immediately prior to the commencement of mowing operations.

19. Clearance of stones, tree stumps, logs, brash, rocks or piles of similar debris will be undertaken carefully and by hand. Although this is only required in a few areas where the proposed site tracks traverse low stone walls. This work will not take place during the hibernation period for common lizard (i.e. mid-October to mid-March).

20. Clearance of tall vegetation will be undertaken using a strimmer or brush cutter with all cuttings raked and removed the same day. Cutting will only be undertaken in a phased way which will either include:

    Cutting vegetation to a height of no less than 30mm, clearing no more than one third of the site in anyone day or;

    Cutting vegetation over three consecutive days to a height of no less than 150mm at the first cut, 75mm at the second cut and 30mm at the third cut;

21. Following removal of tall vegetation using the methods outlined above, the remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming to discourage common lizards from returning. Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works described above.

22. As an additional precaution the ECoW will be present from the commencement of clearance/construction with a watching brief to ensure that no common lizards remain within the construction corridor and remain in situ until the area is cleared to ensure no species or habitat conflicts emerge affecting damage to the local lizard population.

[2] Froglife Advice Sheet 10 Reptile Survey, an introduction to planning, conducting and interpreting surveys for snake and lizard conservation

23. If any common lizards are found during excavation works, all works within the affected area will cease until the ECoW has safely removed them (under licence) from the construction corridor.

24. Should it prove necessary during site supervision (i.e. lizards are observed returning to the construction corridor); a protective lizard barrier fence will be installed along both sides of the construction corridor in order to prevent common lizards from entering the works area.

25. In total, there is >500 ha (of blanket bog; dry heath and marshy grassland) adjacent to the proposed construction corridor. These areas together provide more than sufficient suitable habitat.

Additional measures

26. 37.40ha of existing higher value habitats (likely derived from former heath/bog and fen) will be managed in order to restore these habitats to a more species-rich sward closer to those which once prevailed across the wider area.

27. The main management techniques that will be employed is the reduction in grazing and the blocking of all drains within the proposed habitat management areas. After 5 years the sward will be assessed and compared with the preconstruction baseline for the area. At this point, contingency measures such as the introduction of light grazing will be considered in order to maintain the momentum towards a more species-rich sward, while slowing down successional forces towards scrub/woodland (should this occur).

28. These habitat management measures will also benefit a range of NI Priority Species including common lizard; by creating a number of 'refuges' within which grazing is prohibited (or at a significantly reduced level).

Conclusions

29. With the implementation of the mitigation measures described above, there will be a minimal impact to the local lizard population on Unshinagh. However, with the habitat management proposals there will be a net gain for this species.

Contents

Introduction

1. The HMP has been designed to ensure substantial overall net benefits for biodiversity in the form of an increase in the overall area of NI Priority Habitats on the site (i.e. blanket bog and wet/dry heathland).

2. This will be in the form of the restoration of a substantial area of former blanket bog within the LUAC as well as the active restoration of two adjacent area of peatland which have been under coniferous forestry for the previous few decades. In addition, an area of semi-improved grassland

Background/Aims

3. This HMP aims to fulfil the requirement for an overall 'net gain' of biodiversity by outlining recommendations for compensatory habitat restoration and management to offset the loss of NI Priority Habitats that will result from the construction of the proposed Unshinagh windfarm.

Statement of Authority

4. This report was prepared by Mr Cormac Loughran (CEnv MCIEEM MSc). Cormac is a Chartered Environmentalist (CEnv), and a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). He holds an MSc (Distinction) in Environmental Management from the University of Ulster. Cormac has worked as a consultant ecologist for over 17 years, and in the wider nature conservation sector for a further 9 years. He has extensive experience in ecological impact assessment and HMPs in particular; having undertaken and coordinated full EcIA's (including HMPs) and associated impact assessments for 25 major wind farm developments.

Habitat Management Block A – 49.8 ha

Description

5. This area consists of an extensive mosaic of wet heath, degraded blanket bog & rush pasture with drier pockets of acid/semi-improved grassland and small patches of gorse scrub.

6. Before enclosure this area would have been part of an extensive upland mosaic consisting primarily of upland blanket bog and wet heath. Since then, Block A has been exploited for peat and extensively drained for agricultural purposes (with both cattle and sheep grazing evident). This has resulted in much of the area becoming marshy/acid grassland with significant patches of rush pasture. However, due to it topography, much of the land remains wet and is therefore considered highly suitable for restoration.

Prescriptions

7. The area is currently heavily overgrazed and would therefore benefit from a moratorium on grazing for 12 - 24 months. After which it would be cattle grazing only (no sheep).

8. There will be no application of fertiliser (including farmyard manure or slurry), on areas of wet grassland, degraded blanket bog, wet heath or PMGRP. This exclusion will not

apply to the areas of semi-improved/improved grassland.

9. No supplementary feeding at any time;

10. Extensive and substantial drain-blocking will be implemented. Water levels will be maintained high across the entire year, not just seasonally);

11. Cut vertical banks of former peat cutting will be graded to a more natural angle and revegetated. Any excess peat can be used elsewhere in the Block for repairs. Bare areas that do not revegetate within 12-months will be covered with coir matting and seeded with material collected from within the Block.

12. Soft rush will be manged so as not to constitute more that 30% of the block.

Grazing

13. There will be no sheep grazing for the lifetime of the HMP;

14. Grazing with cattle at a moderate intensity is recommended; as this creates a mosaic of tussocks and short turf. This produces germinating pockets for native plants and also creates the necessary structure preferred by a range of nesting wader species. It also augments the invertebrate population through dunging.

15. To avoid poaching and allow for the restoration of a more biodiverse habitat (and to prevent trampling of nests), light grazing will be maintained between mid-March and June. Although stocking rates generally in the region of 0.75 livestock units per hectare are recommended, it is considered better to use habitat/species (i.e. blanket bog/curlew) objectives rather than set too many ridged prescriptions.

16. For Block A; approximately 75% is grassland and 25% is blanket bog/heath. Therefore, initially targets will be 40 livestock units (which can be adjusted based on habitat condition after each round of habitat monitoring).

Rush management

Management by topping and cattle grazing

17. Livestock tend not to graze rushes, but cattle can destroy tussocks by trampling. They can therefore be used to restore a heavily rush infested pasture to a more open grass dominated sward. This is especially effective after cutting the rush low to the ground as they may eat some of the young growth.

18. Rush cover will only be topped after the last wader chicks have fledged (August is a safe month to cut). Cattle can then be introduced to graze the aftermath. The stocking rate should be low enough to prevent poaching, as this will encourage the germination of rush seed.

Management by topping and flooding

19. Where the water level can be raised, cutting followed by flooding is a cheap and efficient method of killing the root ball of rushes. To be effective, the water level should be raised immediately after cutting. This could be used in parts of Block A where the local topography allows.

Management by topping and herbicides

20. Herbicide control will only be used as a last resort since the approved chemicals are all broad-spectrum herbicides that will also destroy other non-target plants.

21. The rushes will be cut and treated (by hand using a brushcutter and knapsack sprayer). The target will be between 10 – 30% in any year (and not as a single block). In flatter areas, and when the rush regrowth stands higher than the other vegetation in the field, then glyphosate could be applied using a weed-wiper (pulled by an ATV) and set above the height of the rest of the sward. Pesticides will only be used and applied by personnel with the proper Lantra approved training.

Water-control levels

22. Water control structures, such as sluices, enable the ability to control the inflow or outflow of water and thus the water level in the Block. These will be used in certain areas in the event that the rewetting is at risk of spilling over into adjacent areas of land outside of Block A.

23. This will also allow close control of water levels to prevent the grassland drying out too soon in early dry weather, while a wet spring may result in levels remaining too high.

24. Surface water will be re-directed from ditches or streams to desired locations in order to rewet as much of the Block as possible.

25. The most cost-effective sluice is likely to be constructed with a length of plastic piping, either rigid pipe with a swivel end or flexipipe, laid through an earth dam in the outflow ditch. Each end extends beyond the dam, and the upstream end is held at the desired level. Flexipipe will normally need weighting to keep the lip submerged and require a length of rope to hold the upstream end at the desired level. Adjusting the upstream end (by swivelling the pipe or raising or lowering the rope) will set the desired water levels.

26. A high-water table will be maintained from December to March (main growing season for sphagnum spp.) with splashy conditions over the whole field and/or shallow flooding from one to 30cm over up to 30 per cent of the field (for waders where possible).

27. Water levels will be allowed to naturally fluctuate to avoid stagnation.

28. From March to May a high water (but reduced, water table) level will be retained over 30 per cent of the field and/or shallow flooding on five to 10 per cent of the field.

29. From May to July, retain the water table within 20cm of field level on average, shallow pools will dry out, with muddy edges.

30. From July, water-levels can be reduced to at least 40cm below field level to enable management to be undertaken (as required). However, this will only occur if required.

Fencing

31. Internal fencing within the Block will be taken down for the lifetime of the management plan.

Outcomes/targets

32. An overall increase in area of blanket bog, wet heath and wet grassland over semi-improved areas. Increase in quality/species diversity of the habitats should be evident

over time with a concurrent increase in percentage cover of sphagnum.

Benefits

33. Additionally, these prescriptions will also benefit Irish hare, smooth newt, viviparous lizard and a wide range of dragonfly (and some butterfly species. As well as some hoverflies and lesser know invertebrate species.

Land Management for Curlew (49.8ha (Block A)

Overview of Key Points:

- The grazing regime is important and would aim to provide a mosaic of taller tussocks and short sward with a small amount of bare ground
- The timing of grass cutting and other related machinery operations is critical
- Areas of damp / wet ground or small, shallow pools should be provided

Detailed Specific Measures:

34. The application of lime and / or any organic or chemical fertilizer (with the exception of farmyard manure) is not permitted between 1st February and 15th July

35. From the end of March to the end of June stock density should be low and not exceed 0.75 LU/ha

36. After the end of June and during the winter period normal or higher density grazing can occur but it is still important not to overgraze

37. Cattle are the preferred livestock however the grazing density of livestock has a bigger influence on the vegetation than the type of livestock

38. Cattle should not be put onto land managed for curlew immediately after winter housing (this can increase nest damage)

39. Rushes should be cut if they become dense and tall over more than 50% of the field

40. If the fields are used for silage or hay (or if rushes need cut) then cutting should not be before mid-July; fields should if possible be cut from the centre outwards

41. Some scrub or tree management may be required and this should not be carried out during 1st March to 31st August inclusive; trees should not be planted close to fields managed for curlew

42. Wet, soft ground is important for curlews and drainage ditches and grips (where present) should be blocked using suitable piling dams and / or re-profiled to make them shallower; these operations should be done after mid-July

43. New field fences should be avoided and consideration given to removing existing fences if practicable

Restoration of former Forestry

44. As shown in Figure 6.10, two areas of former coniferous plantation forestry (Block B (7.5 ha) and Block C (5.9 ha)) are to be restored as part of this HMP. These areas will

have to be felled to facilitate the construction phase of the wind farm. In addition, the NIEA Environment Mapviewer also shows most of these areas' as former peatland or peat-cutting.

45. Therefore, most of these areas will require further maintenance to complete the reinstatement to peatland. Areas where plantation forestry still retain the ability to revert to semi-natural vegetation, as these still comprise peatland vegetation beneath the conifers. In order to facilitate the reestablishment of peatland vegetation within these areas and maintain an effective hydrological regime, the following measures are proposed in these areas:

- Treatment of brash from felled areas via off-site removal or chipping;
- Drain blocking will be undertaken on a local scale in the immediate surroundings of felled plantation by installing plastic dams at drainage ditches (largely remnant semi-functioning conifer forest drains) to maintain, enhance and restore the favourable baseline hydrological and ecological conditions at each site location. Drains can be dammed using peat dams;
- No grazing will be permitted for the lifetime of the Development on the restoration of former forestry areas (circa. 25-yrs);
- No additional drainage to be installed in proximity to these habitat areas during the lifetime of the development;
- No supplementary feeding at any time;
- The use of off-road vehicles on the site will be restricted to the existing tracks post construction;
- No application of chemical and organic fertilisers or herbicides and pesticides will be undertaken within areas of restored conifer plantation;
- Self-seeded conifers will be cleared and removed (by hand or brushcutter) from the newly created peatland reinstatement areas on an ongoing basis (annually or bi-annually for 25 years) during the operational phase.

7. Monitoring

46. To confirm that habitat management and enhancement has been successful, all areas will be monitored post-construction, monitoring results reported and any criteria failures identified and corrective actions implemented as part of the annual monitoring report.

47. Botanical/vegetation monitoring will be carried out in years 1, 2, 3, 5 and 10 after restoration (with reports submitted to the Department within 6 months of the end of each monitoring year).

48. Monitoring will involve the following:

<u>Vegetation sampling</u>

- 90 fixed quadrat locations (i.e., permanent quadrats) will be set up in areas where active management is proposed (i.e. Blocks A, B & C. Baseline data will be recorded prior to the commencement of the habitat management activities set out in this outline plan. The character of each quadrat will be recorded (e.g. species proportions present, vegetation structure and height) and photographs will be taken of each quadrat from a fixed point. These quadrats will then be re-examined during years 1, 2, 3, 5 and 10 following management/restoration in order to establish the extent of habitat improvement resulting from management practices.

<u>Hydrological monitoring</u>

- Water levels within areas where drains are blocked will be recorded bi-annually for three years. A number of phreatic stand pipes will be installed (prior to restoration) to allow monitoring of water levels within both the restoration and enhancement areas. In this way, any positive impacts on the local hydrology can be verified and quantified.

49. The efficacy of the habitat rehabilitation and enhancement measures employed will be reviewed in years 1, 2, 3, 5 and 10 following commencement of the plan on the basis of the results of vegetation sampling and water level readings from the managed areas. Analysis of the data collected will be the basis for a review of the measures and techniques employed.

8. Criteria for success

Management & restoration of Block A (49.8ha)

50. Correspondence, photographic & mapping evidence will be provided as part of the year 1 monitoring report as follows;
    - Confirmation email/letter that the grazing prescription has been adhered too.
    - Installation of dams/sluices as per Figure 6.11).
    - 90 Fixed point quadrats should show the following changes over time;
        - Increase in species diversity;
            - 5% per annum for first five years.
        - Increase in sward height;
            - 5% per annum (from baseline).
        - Decrease in evidence of poaching/grazing (i.e. dunging);
            - 5% per annum for 3-years.
        - Increase in sphagnum cover;
            - 5% per annum (from baseline) for first 10 years;
        - Increase in pools/water cover.
            - Not specified.

Restoration of former Forestry (10.1 ha))

51. The proposed forestry restoration areas (Blocks B & C) are relatively flat and the forestry drains so numerous as to make sheet dams impractical and also expensive. It is recommended that traditional dams are installed every 15 to 25m with the conifer stumps used to block the forestry drains every 2.5m. This is acceptable as the forestry drains are only around 30cm deep and the gradients are shallow.

52. The works on-site would be undertaken using a wide-tracked excavator. Works will involve blocking drainage channels by flipping the stumps of felled trees over into the channels and covering (but not smoothly out) the remnant peat. The aim is to restore the hydrology of the underlying peat bog to a near natural state, and recreate the conditions needed for peat forming plants to recolonise the site.

53. Photographic & mapping evidence will be provided as part of the year 1 monitoring report as follows;
    - Treatment of harvesting brash
        - Photos of results
        - Fixed point photos from each quadrat (at each point of the compass)
    - Installation of dipwells (see Annex 1 – Hydrological Monitoring Protocol)
      Photos of 60 dipwells along with fortnightly readings (along with commentary)
        - Dipwells will be located within 5m of quadrat locations (Blocks B & C).

54. Depth to water table from the surface and its fluctuation will be implemented with the target of a stabilisation of the water table with fluctuation +/- 20cm above or below ground and a restored acrotelm for the restoration of peatland habitats. Should the target (on review of monitoring results) not be met then further drain blocking measures (and additional contingency measures) will be agreed with NIEA NED.

55. However, it is entirely possible that the restoration will result in a mosaic of blanket bog, and wet & dry heath. This is one possible outcome due to the damaged hydrology of the site and surrounding area. The resulting mosaic will likely include vegetation types which are all NI Priority Habitats and will still result in a net gain for biodiversity.

9. Reporting

56. Reports detailing the monitoring works carried out, the results obtained and a review of their success, along with any suggestions for amendments to the plan will be prepared in years 1, 3, 5 and 10; following commencement of the plan's implementation. Reports will be submitted within 6 months of each monitoring year.

Unshinagh Wind Farm

Habitats Regulations Assessment

ANTRIM HILLS SPECIAL PROTECTION AREA

Stage 1: Test of Likely Significance

Name of Project or Plan.	**UNSHINAGH WIND FARM**
Project reference *(Planning ref. etc.):*	**-**
File number:	**-**
Name and location of Natura 2000 site.	**Antrim Hills SPA (EC Site Code UK9020301)**
Natura 2000 site features:	**SPA selection species:** the SPA supports nationally important breeding populations of **hen harrier** and **merlin**
Description of the Project or Plan • **Size and scale;** • **Land-take;** • **Distance from Natura 2000 site or key features of the site;** • **Resource requirements (water abstraction etc);** • **Emission (disposal to land, water or air);** • **Excavation requirements;** • **Transportation requirements;** • **Duration of construction, operation, de-commissioning etc;** • **Other.**	Size and scale The project is for a 14 turbine wind farm and associated infrastructure. The 14 turbines will have a maximum overall height of 180 m and a maximum rotor diameter of 136 m. Distance from Natura 2000 site or key features of the site The proposed project is immediately adjacent to part of the boundary of the SPA site. Four of the proposed turbine locations (T7, T9, T12 and T13) and their associated infrastructure are located within the boundary of the SPA site. Recent confirmed hen harrier nest locations (a key feature of the SPA site) are not closer than 4.2 km from the proposed turbine locations. Recent confirmed merlin nest locations (a key feature of the SPA site) are >5 km from the proposed turbine locations.
Is the proposal directly connected with or necessary to management of the site for conservation of N2K features? **If yes proceed no further.**	No
Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site.	Any likely impacts would be due to the construction and / or the operation of the wind farm

N2K Feature: Mention all features	**Describe any likely direct or indirect effects to the N2K features arising as a result of:** • **loss;** • **reduction of habitat area;** • **disturbance;** • **habitat or species fragmentation;** • **reduction in species density;** • **changes in key indicators of conservation value (e.g. water quality, climate change).**	***Effect Significant/Not Significant? Why?**
merlin	**Direct effects (disturbance):** no likely effects	**Not significant** (no likely effects)
	Indirect effects (displacement): no likely effects	**Not significant** (no likely effects)

hen harrier	**Direct disturbance of <u>nest sites</u>:** no likely effect	**Not significant** (no likely effect)
	Direct loss of potential *nesting* habitat: no likely effect	**Not significant** (no likely effect)
	Direct loss of *foraging* habitat: there will be a direct loss of **8.47 ha** of potential foraging habitat due to proposed infrastructure located within the SPA site	**Not significant:** • the amount of habitat that will be lost is very small relative to the overall observed foraging range of hen harriers nesting within the SPA site • the location of the habitat that will be lost is significantly beyond the likely core foraging range of hen harriers from recent confirmed nest sites (and likely future nest sites) located within the SPA site • it is therefore unlikely that direct habitat loss would be significant
	Direct loss of birds due to collision mortality: no likely effect	**Not significant** (no likely effect)
	Indirect loss of foraging habitat: there is a predicted 52.5% reduction in hen harrier foraging activity within a 500 m extent from the project	**Not significant:** • observed low frequency of harrier foraging activity within a 500 m extent from the project • the project is located significantly beyond the likely core foraging range of hen harriers from recent confirmed nest sites (and likely future nest sites) located within the SPA site • it is therefore unlikely that the predicted reduction in foraging activity would be significant

***Only mitigation measures designed within the application can be considered at this stage. Any conditions that NIEA would impose must be assessed through the appropriate assessment stage.**

Describe any potential effects on the Natura 2000 site as a whole in terms of: interference with the key relationships that define the structure or function of the site	**Effect considered significant/non-significant: Finding of No significant effects Matrix**
No likely direct or indirect effects	**Not significant** (no likely effects)

Provide details of any other projects or plans that together with the project or plan being assessed could (directly or indirectly) affect the site.	**Provide details of any likely in-combination effects and quantify their significance -**
Two operational wind farms (Rathsherry Wind Farm and Elginny Hill Wind Farm) are located to the southwest of the SPA site	**No likely effects:** • neither project is located within the likely core foraging range of hen harriers from recent confirmed nest sites located within the SPA site

Is the potential scale or magnitude of any effect likely to be significant?	
Alone?	**Yes☐ No☒**
In-combination with other projects of plans?	**Yes☐ No☒**

List of Agencies Consulted:	**-**
Above consultee response.	**-**

Conclusion: Is the proposal likely to have a significant effect on an N2K site?	**Yes☐ No☒**
IF IT HAS BEEN DETERMINED THAT THE PROPOSAL WILL NOT HAVE A SIGNIFICANT EFFECT THEN ASSESSMENT IS COMPLETED. **IF ANY PART OF THE PROPOSAL IS LIKELY TO HAVE A SIGNIFICANT EFFECT AN APPROPRIATE ASSESSMENT WILL BE REQUIRED – STAGE 2 AA.**	

Data collected to carry out the assessment

Who carried out the assessment?	**David Steele B.Sc. (2i Honours), Zoology, University of Aberdeen (1988)**
Sources of data	• two years of baseline ornithology surveys completed by David Steele within the site of the proposal and in appropriate surrounding buffer areas • baseline hen harrier surveys completed by David Steele within the local part of the Antrim Hills SPA site • SNH published guidance on assessing connectivity with Special Protection Areas (June 2016)
Level of assessment completed	Stage 1 – Test of Likely Significance
Where can the full results of the assessment be accessed and viewed?	**Environmental Statement for Unshinagh Wind Farm**
NIEA CDP Response to consultation.	**-**

Unshinagh Wind Farm

Outline Construction Environmental Management Plan (outline CEMP)

Document Nº: 04291-3233244

CONTENTS

1.0 INTRODUCTION

This Outline Construction Environmental Management Plan (outline CEMP) is submitted by RES Ltd (RES). The principal objective of this document is to provide information on the methodologies to construct and decommission Unshinagh Wind Farm, to provide information on the expected methodologies to construct and decommission Unshinagh Wind Farm.

As the outline CEMP is being prepared as part of the planning application, RES Ltd are yet to appoint a wind turbine manufacturer or contractors to undertake the electrical or civil engineering works. The contractor(s) appointed to construct the project will prepare detailed method statements to construct the works which will align with the details in this outline CEMP.

This outline CEMP sets out the overarching construction management philosophy for the site and provides further details on specific activities that will be undertaken on the site.

The Annexes within the Outline CEMP include information/ reports produced for the Environmental Statement, and avoid unnecessary duplication. They have not been reproduced in this document but signpost to the relevant location within the Environmental Statement.

1.1 Project Description

The Development comprises 14 three-bladed, horizontal axis wind turbines, each up to a maximum of 180 m to tip height, associated external electricity transformers; underground cabling; a newly created site entrance; access tracks; turning heads; crane hardstanding's; control building and substation compound, energy storage containers, off-site areas of widening to the public road and all ancillary works. During construction and commissioning there would be a number of temporary works including a construction compound with car parking; temporary parts of crane hardstanding's; welfare facilities and temporary guyed meteorological masts. Works will also include the felling of trees to create access to the site for construction and facilitation of 3rd party access. Tree felling and Turbine lighting will also be installed.

Relevant Drawings of the site infrastructure are included within Annex 1.

Table 1.1: Outline Project Programme

TASK	CONSTRUCTION MONTH																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Mobilisation & setup construction compound																		
Site entrance and tracks																		

Crane hardstandings																		
Turbine foundations																		
Control building & substation																		
Cable installation																		
Turbine deliveries																		
Turbine erection																		
Operational take over																		

1.2 Conditions of Consent

Planning permission for the construction of the wind farm is yet to be received. Upon receiving conditions, RES Ltd will provide an update to illustrate how applicable conditions will be discharged, aligning current construction methodologies with relevant legislation and environmental protection practices.

1.3 Community Liaison

Throughout the construction period of the project, RES Ltd will maintain an open dialogue with local residents and all other interested parties. RES Ltd will ensure the local community is provided with regular updates on the progress of construction and upcoming activities through appropriate channels.

A member of staff will be appointed for responsibility of key contact between RES Ltd and the community. This person will be the nominated point of contact for local residents in connection any issues that may be raised during construction, operation and decommissioning of the wind farm.

Any change to the appointed person shall be communicated to the planning authority and the local community representatives as required.

2.0 GENERAL CONSTRUCTION MANAGEMENT PRINCIPLES

Unshinagh Wind Farm will be constructed in accordance with the Environmental Statement (2021), prepared during the development stage of the project and in line with good practice outlined in the Scottish National Heritage guidance "Good Practice during Windfarm Construction"- 4th Edition 2019.

Throughout the development of the project, the aim has been to ensure the design:

- Minimises the extent of infrastructure;
- Avoids sensitive habitats;
- Minimises environmental impacts; and
- Maximises health and safety.

Where appropriate and practicable, local plant and materials will be used in order to maximise the benefit of the wind farm project to the local economy.

2.1 Environmental Management and Pollution Prevention

Specific procedures to ensure that the local environment is protected during construction works are managed through our Environmental Management System Procedures and Policies which is certified to ISO 14001.

2.1.1 Contractors Requirements

Details of the environmental management and emergency procedures to be adopted by Contractors during the construction phase are contained within the RES management system procedure Safety and Environmental Requirements of Contractors – 01059R00038.

2.1.2 Surface and Ground Water Management

A sustainable drainage system (SuDS) will be implemented to provide a series of surface water management techniques to mitigate any adverse impact on the hydrology of the site.

The Unshinagh preliminary design details, criteria and philosophy for the SuDS system has been provided in document Flood Risk and Drainage Assessment, within Vol 4, Section 9 of the ES).

2.1.3 Water Quality Monitoring

Any potential pollution incident on site that may impact water quality will be dealt with in accordance with the RES management system procedure "Procedure in the Event of a Contaminant Spill", included as Annex 5.

Water quality monitoring will be undertaken on discharge waters during the construction phase to ensure that the development does not impact on local watercourses and rivers.

A bespoke water monitoring strategy will be prepared and implemented by a specialist consultant, detailing monitoring locations, sampling frequency and the methodology for chemical and biological analyses. Site sensitivity will be taken into account when deciding on the level and periodicity of sampling and the proposed monitoring plan discussed and agreed with DAERA Water Management Unit prior to implementation.

The exact location of each sampling point will be determined during a walkover survey, and will reflect the point on all relevant controlled waters closest to the proposed active construction areas. Sampling points up- and down-stream of the construction activity will be selected to provide a full profile of the controlled waters.

A baseline report will be prepared following initial pre-construction water quality monitoring. This report will provide details of any contamination concentrations recorded and will be used to depict "uncontaminated background pollution levels" for the site.

In the event of a potential pollution incident, all relevant monitoring points would be visited and re-sampled to determine any changes relative to the baseline data. A report detailing the findings would be prepared for each incident and recommendations provided for further monitoring and / or requisite mitigation measures.

Following completion of the construction of the wind farm, all sample points will be revisited, re-sampled and analysed for a full suite of analytical parameters and a further report prepared discussing any impacts upon water quality arising from the construction process.

2.1.4 Foul Water Management

Foul drainage will be provided in agreement with the relevant authorities and most likely involve the installation of a septic tank and soakaway, or foul effluent disposal with periodic disposal via a licensed haulier.

2.1.5 Noise Management

The sources of construction noise are temporary and vary in location, duration and level as the different elements of the wind farm are constructed. Construction noise arises primarily through the operation of large items of plant and equipment such as bulldozers, diesel generators, vibration plates, concrete mixer trucks, rollers etc. Noise also arises due to the temporary increase in construction traffic near the site.

BS 5228-1:2009 'Noise control on construction and open sites; Part 1 – Noise' is identified as being suitable for the purpose of giving guidance on appropriate methods for minimising noise from construction activities.

For all activities, measures shall be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in Section 72 of the Control of Pollution Act 1974.

It's proposed the following noise mitigation measures will be implemented where appropriate and in line with further guidance from BS 5228-1;

- Consideration will be given to noise emissions when selecting plant and equipment to be used on site. Where appropriate, quieter items of plant and equipment will be given preference.
- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources shall be sited as far as reasonably possible from residential properties and, where necessary and appropriate, acoustic barriers installed to further reduce the impact;
- The movement of vehicles to and from site will be controlled; and
- Employees will be instructed to ensure compliance with the noise control measures adopted.

Should it be considered necessary to further reduce noise levels, mitigation measures would be considered and appropriate measures will be undertaken.

There are many strategies that could be employed to reduce construction noise levels; BS 5228-1 also states that the 'attitude to the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local community should occur. Non-acoustic factors such as mud on roads and dust generation, which can also influence the overall level of complaints, will also be controlled as detailed elsewhere in this document.

In the event that noise complaints are received, the senior RES onsite staff member will contact the complainant and if required, visit the property to discuss the complaint and

objectively assess the noise levels. If the noise complaint is found to be merited, additional mitigation measures will be put in place.

In the event a resolution cannot be reached between RES and the complainant, the planning authority will be informed in order that they can carry out their own subjective assessment and if required agree any additional mitigation.

All noise complaints will be recorded along with actions taken to resolve the issue. These records will be available to the Council on request.

2.1.6 Dust Management

The potential issue of dust creation during the works will be weather and season dependant, therefore detailed dust management methods will be subject to the works programme and contractor working methods.

Dust management will be carried out at all times in accordance with industry best practice to ensure that any local sensitive receptors are not affected by nuisance levels of dust from the works.

The following methods of dust suppression will be considered during the construction phase of the wind farm as required:

- Site tracks to be damped down using bowser or other suitable system;
- Road sweeper to be used to remove loose material from adjacent public roads during construction;
- Cleaning of vehicles, including provision of waterless wheel washing facilities, prior to exiting site onto the public road;
- Soil erosion control measures;
- Speed limits to be put in place to ensure low vehicle speeds;
- Vehicle loads to be covered;
- Damping of dry excavations and cutting activities which generate dust; and
- Sequencing of works to minimise the time that soils are exposed.

2.1.7 Spoil Management Bunds

Plans showing the details of peat and soil stripping at the site and the proposed use and placement of peat, topsoil and subsoil are outlined in the outline Spoil Management Plan included within Annex 6.

2.1.8 On-Site Fuel and Chemical Storage

All fuel and chemicals will be stored within appropriately specified containers and within specifically designed stores / storage areas and shall include appropriate measures to avoid spillages in accordance with Control of Pollution (Oil Storage) Regulations (NI) 2010.

2.2 *Temporary Lighting*

Temporary lighting will be required at the construction compounds for security purposes and to ensure that a safe working environment is provided to construction staff. In addition, temporary lighting may be required to ensure safe working conditions at tracks, control building and turbine locations during construction.

All temporary lighting installations will be downward facing and all lights will be switched off during daylight hours.

2.3 *Peat Slide Risk and Slope Stability*

A Quantitative Slope Stability Assessment has been undertaken as part of the Environmental Statement and the design of infrastructure has taken into account the findings of the assessment. Prior to commencement of construction, detailed method statements will be prepared to address the working methods to be used. Additionally, a "toolbox talk" will be provided by the site management team to highlight possible events causing slope instability and provide guidance on best practice when operating in areas identified as at risk.

2.4 *Post Construction Restoration and Reinstatement*

During construction of the infrastructure elements (detailed in Section 3), the vegetated layer will be stripped from the area of the excavation and stored locally with the growing side up. The remaining organic topsoil and subsoils will be excavated down to formation level, or a suitable stratum, and again will be stored local to the point of excavation, but shall remain segregated to avoid mixing of materials.

Temporary storage areas shall take cognisance of all identified buffer areas and be stripped of vegetation prior to stockpiling in line with best working practices. As construction is progressed the effectiveness of the buffer zones will be reviewed and if necessary adjusted. Alternatively the construction procedure may be reviewed and altered or additional control measures put in place.

Post-construction reinstatement will be undertaken as work progresses to minimise the period of time any organic material is stockpiled. Subsoils shall be used in landscaping and backfilling around structures while the vegetated layer and/or topsoil will be used to reinstate storage and working areas, road verges, drainage swales and embankments. In addition, following the completion of the works, a final inspection of the wind farm site will be undertaken and in circumstances where reinstatement using vegetation and/or topsoil is unsuccessful alternative methods will be considered.

Upon completion of all construction works, the temporary construction compounds will be reinstated to their approximate pre-wind farm condition. All temporary structures and construction equipment will be removed and the granular material that forms the hardstandings will be moved to areas agreed with the landowner or removed from site. Following this, the areas will be backfilled with material stripped and stored during the construction of the wind farm and reseeded as required.

In line with construction best practice and to suit the ground conditions anticipated on site, the track and hardstanding design has endeavoured to minimise spoil generated during construction.

2.5 Traffic Management

Details of the proposed traffic management arrangements will be contained in a Traffic Management Plan (TMP) and shall be agreed with the Roads Authority prior to commencement. Any operations not covered by the TMP will be performed in accordance with local and national standards and specifications. All abnormal load movements associated with the project will be performed in accordance with the anticipated Article 78 Permit, using the proposed delivery routes shown on drawing 03128-RES-ACC-DR-LO-001, *Proposed Delivery Route to Site*.

2.6 Health and Safety Management

The Principal Contractor will be responsible for ensuring that a construction phase health and safety plan is prepared and implemented on site. All work will be carried out in accordance with:

- The Health and Safety at Work etc. Act 1974;
- The Construction (Design and Management) Regulations (NI) 2016; and
- All applicable third party safety guidelines.

2.7 Environmental

An Ecological Clerk of Works (ECoW) will be appointed, and will be fully engaged in preparatory works that have been undertaken, with their terms of appointment extended throughout the construction period into the operational period. The agreed terms of appointment to be agreed with the Planning Authority, will be provided prior to construction.

The provision of an Archaeologist will be implemented during the excavation works, in agreement with the Planning Authority. A written Scheme of Investigation will be provided and agreed with the Planning Authority ahead of being applied to all relevant areas of work.

3.0 DESIGN PHILOSOPHY AND CONSTRUCTION METHODS

3.1 Site Entrance

Traffic associated with construction of the wind farm will access the site from a newly created site entrance which shall be accessed from the A42 Ballymena/Carnlough Road in accordance with the TMP. Wheel cleaning facilities will be set up at the main entrance to remove mud from the wheels of vehicles leaving the site. Public roads will be inspected daily and a road sweeper will be employed to remove any mud or debris transferred onto the roads from site activities.

3.1.1 General Construction Method

The site entrance will be upgraded in accordance with the design drawings as follows:

- Traffic management to be installed;
- Topsoil shall be removed and carefully stockpiled;
- New highway drainage shall be installed taking care to ensure that existing drainage will not be compromised;
- Road pavement works to be completed to the design requirements; and
- Line marking, signage, fencing and vehicle restraint systems required as part of the design will be installed.

3.2 Temporary Construction Compounds, Site Tracks and Crane Hardstandings

3.2.1 Temporary Construction Compounds

Temporary construction compounds are required for the provision of site offices, welfare facilities and storage arrangements for materials, plant and equipment. There is one temporary construction compound required for the project.

The temporary construction compound will be constructed at the location indicated on Drawing 03128-RES-PRO-DR-PT-001 Infrastructure Layout, in Annex 1.

Temporary welfare provision will be made available during construction of the access tracks to the main construction compound.

The main construction compound will be the main compound for the site with welfare facilities at this location.

An area will be assigned for the storage of fuels and chemicals, ensuring any spillage is captured and appropriately dealt with. Refuelling will be undertaken in line with the requirements as outlined in the Safety and Environmental Requirements of Contractors 01059R00038 (Annex 2).

3.2.2 Site Tracks

The running width of the tracks will be typically 4.5 m on straight sections, increasing at corners and passing places to accommodate the swept path of turbine delivery vehicles. The track working area will be kept to the minimum required allowing for working area, safe access, drainage and electrical works.

Site tracks will consist of a compacted stone structure. Where tracks cross over services such as gas pipelines or electricity cables, they will be designed after consultation with the relevant authority and in accordance with their specific requirements.

A number of track designs may be utilised on site which will be determined during detailed design, dependent on the ground conditions encountered on site and include:

- Typical Track founded on suitable load bearing strata;
- Floating Track;

Track drainage will be incorporated within the design in accordance with sustainable drainage design principles. Where the road alignment crosses existing drainage channels, crossings appropriate to the location will be designed in accordance with the relevant guidelines.

A buffer zone in accordance with the relevant guidance from Northern Ireland Environment Agency, will be maintained around watercourses shown on Drawing 03128D2101, in Annex 1. The exceptions to these buffers will be where the existing tracks are located within the buffer zone and where there are watercourse crossings. Site personnel will be made aware of the buffer zones through the site induction and specific tool box talks.

Typical Track

Typical track construction may be used in areas identified where the thickness of soft soils is low, and the underlying layer has adequate load bearing properties. This track system will likely consist of a suitable capping layer and then a suitable running layer.

Floating Track

Floating track construction may be adopted where the ground conditions require. This system involves installing geo-grid directly onto the organic or exposed soil layer and placing layers of suitable stone and additional geo-grid (as required) above until the track design level is achieved.

3.2.3 Crane Hardstandings

The main crane hardstanding area is anticipated to be 40m x 30m. There may be additional temporary hardstanding areas required for the erection of the main crane, lay down of materials and turbine components.

The main crane hardstanding area will be left uncovered for the operational lifetime of the wind farm in line with good practice outlined in the Scottish National Heritage guidance “Good Practice during Windfarm Construction”. Temporary crane hardstanding elements will be reinstated post construction.

- All crane hardstandings will consist of one or a combination of the following:
- A compacted stone structure bearing directly on a suitable formation strata;
- A compacted stone structure bearing on an formation strata strengthened through ground improvement techniques; or

A compacted stone structure bearing on a strengthened soil mass created by the installation of multiple stone or concrete columns.

3.2.4 General Construction Method

Where competent soils exist close to the existing ground surface the following construction method will typically be followed:

- Areas will be adequately marked out prior to construction;
- Material will be excavated and stored;
- Cut track construction will be used where soils are identified as being shallow. This cut track system will likely consist of a suitable layer of crushed aggregate, either spread by a dozer or placed by hydraulic excavator, prior to being compacted in layers by vibratory rollers. If ground conditions dictate a geotextile membrane will be applied;
- Drainage swales will be excavated adjacent to the 'cut' tracks where required. Surface water runoff will not be allowed to discharge directly into existing watercourses but will be routed through a Sustainable Drainage System (SuDS);
- A surface water cut off ditch may be installed on the slope above the earthworks footprint where achievable given the topography;
- Where the road alignment crosses existing drainage channels, crossings appropriate to the location will be designed in accordance with the relevant guidelines;
- Depending on depth and type of material, cut slopes are anticipated to be between 1:1 to 1:3;
- Post-construction reinstatement shall be in line with the details of Section 4.0;

Where the load bearing properties of the underlying soils are determined to be insufficient, ground stabilisation may be carried out to provide adequate bearing capacity of the formation level. Due to the variable nature of the ground at the site, specific construction methods shall be selected at detailed design stage in consultation with specialist contractors. Such methods may consist of:

- Compaction of the existing in situ soils;
- Lime/cement stabilisation of the existing in situ soils; or
- Installation of stone or concrete columns to provide adequate support.

3.3 Turbine Foundations

Foundations will be designed in accordance with the relevant design standards. Due account will be taken of guidance provided in appropriate codes and standards such as Eurocodes, British Standards and other specialist design documents.

Due to the anticipated load bearing capacity of the near surface soils, gravity base turbine foundations are expected to be used to support the wind turbine.

The foundations will be designed as a reinforced concrete slab. The foundation geotechnical design will be based on the information contained in the site investigation reports produced by the appointed Geotechnical Engineer.

3.3.1 General Gravity Base Construction Method

The gravity base foundation general construction method would generally be as follows:

- The topsoil will be excavated and stored to one side for reuse during the landscaping round the finished turbine;
- Excavation will be undertaken to competent material. Excavated subsoil material may be stockpiled temporarily adjacent to the excavation for later use as backfill or stored elsewhere on site. Temporary & permanent drainage shall be installed at the same time as the excavation works;
- In the case where competent material is lower than the required formation level the foundation will likely be over-excavated to competent material and compacted engineering fill placed to the required level;
- Where excavation is required to extend below the water table or in material which does not drain freely, appropriate pumping will be employed to keep the excavation dry. Water pumped from an excavation shall not be discharged directly to any watercourse;
- A layer of concrete blinding will be laid directly on top of the newly exposed formation, finished to ensure a flat and level working surface;
- Steel reinforcement, the turbine anchorage system and cable ducts will be fixed in place and formwork erected around the steel cage;
- Concrete will be placed using a crane, pump or other suitable lifting device and compacted using vibrating pokers;
- The foundation will be backfilled with suitable material, and landscaped using the vegetated soil layer set aside during the initial excavation; and
- A gravel path will be built leading from the access track or crane hardstanding to the turbine door or access steps and around the turbine for maintenance.

3.4 Turbines and Turbine Transformers

3.4.1 Turbines

The turbine will typically be supplied with a light grey semi-matt finish (RAL colour 7035) and installed with a height not exceeding 180m measured from ground level to the blade tip in the vertical position.

The turbines shall not carry any symbols, logos or other lettering except where required under other legislation. However, RES propose to add turbine numbers to the base of each tower to aid service engineers during the operational phase of the wind farm.

In line with Health and Safety best practice, turbine manufacturers have indicated a preference to locate a passive infra-red (PIR) detector and light above each turbine door. It should be noted that this lamp will not be permanently lit and would only be switched on by the PIR when personnel approach a particular turbine.

Specific locations for the turbines are as per Figure 1.3, Turbine Layout Drawing, in Annex 1.

3.4.2 Turbine Transformers

Depending on the model of turbine finally chosen for the site, turbine transformers will either be placed internally or externally in close proximity to the turbine.

Oil cooled transformers will be supplied full of oil and will not require topping up on site. The transformers will be sealed and will be inspected for any damage prior to offloading. Air cooled or cast resin transformers do not require cooling oil.

The transformers will be located within enclosures which shall be locked, accessible by trained and authorised personnel only, and displaying appropriate warning signs.

3.4.3 General Turbine Erection Method

The following general steps will be undertaken in order to erect the turbines on site:

- Some turbine components will be pre-delivered in sections to the site and offloaded at the crane hardstandings;
- The remaining turbine components will be delivered on a just-in-time basis and be lifted directly from vehicle trailers;
- Turbine components will be lifted by adequately sized cranes (one main crane and one smaller tail crane) and positioned on the foundations / other turbine sections until the entire turbine is erected;
- Upon completion of the erection all fasteners will be tightened and the internal fit out of the turbine undertaken;
- The turbines will then be connected to the wind farm substation; and finally

Turbine testing and commissioning will be undertaken before the turbines will be handed over as complete.

3.5 Control Building and Substation Compound

Cables will export power from the wind turbines to the substation compound and control building before being transferred to the National Grid. The location of the Control Building and Substation Compound is shown on Figure 1.3 Infrastructure Layout, in Annex 1.

The RES Ltd control building has been designed, sized and positioned to be sympathetic with the surroundings. The building contains the following rooms; control room, switch room, SCADA room, and equipment store and welfare facilities.

The detailed design of the foundations for the building will be based on the Site Investigation reports and building requirements, and will ensure loads associated with the building are transferred to the appropriate bearing layer in the sub-surface.

The building will likely consist of block cavity wall construction, with a render external finish.

Foul drainage will be provided in accordance with Building Control requirements and in agreement with the relevant authorities.

3.5.1 Sub Station Finishes

Control Building finishes to be agreed with the local authority as follows:

- Walls to be finished with render;
- Roof tiles are typically concrete; and
- Doors & windows to be made or framed by steel or timber with steel shutters on the windows for security (if applicable).

3.5.2 General Construction Method

The control building and substation compound will generally be constructed in accordance with the following:

- The plan area of the substation control building and compound will be set out and the topsoil stripped and removed to a temporary stockpile;
- The building foundations will be excavated and concrete poured;
- The building structure will be constructed from the foundations, in accordance with current practice and specific design;
- The internal fit out of the building including installation of services will be completed.

3.6 Cabling Works

All electricity and other service cables between the turbines and the substation / substation control building will be placed underground.

The detailed construction and trenching specifications will depend on the ground conditions encountered but typically cables will be directly buried inside a trench, except at road crossings when cables will be ducted.

3.6.1 General Construction Method

The following construction method will typically be used:

- Trenches will be excavated and a suitable bedding material placed for which to lay the cables upon. The ground is trenched typically using a mechanical digging machine;
- The cables shall be laid directly onto the bedding material;
- The trench will then be backfilled and compacted with suitable material up to the required level and finished with a layer of topsoil to aid in the trench reinstatement;
- A suitable marking tape is installed between the cables and the surface; and
- The cables are terminated on the switchgear at each turbine and at the substation.

4.0 OUTLINE DECOMISSIONING PLAN

Prior to decommissioning, a detailed site restoration scheme will be provided to the Local Planning Authority for written approval in line with applicable Planning Condition.

Outlined in the following sections are the general procedures to be followed in the decommissioning of the wind farm based on current knowledge.

4.1 Site Track & Hardstanding Areas

New site tracks and hardstanding areas constructed during development of the wind farm will be reinstated to the approximate pre-wind farm condition, unless otherwise agreed with the Landowner and/or Local Planning Authority. Areas to be reinstated would be treated in the following way:

- The material used to construct the tracks will be taken up and removed to areas identified in the site restoration scheme;
- The areas will be backfilled with suitable fill material, covered with topsoil and reseeded as required; and
- Backfilling of access tracks will be carefully planned in advance to avoid having to unnecessarily move plant and equipment on freshly reinstated land.
- Any tracks which were upgraded during the development of the wind farm would be reinstated to their original width, or at the request of the landowner, left unchanged from the conditions used during the operational phase of the wind farm.

4.2 Wind Turbines

The decommissioning of the wind turbines will be the reverse of the erection process involving similar lifting plant and equipment:

- Wind turbines will be disconnected from the cabling and internal components stripped and taken off site;
- It is anticipated that the turbine nacelle would then be taken down and loaded straight onto the back of transport vehicles and removed from site for reconditioning or scrap; and
- The turbine towers and blades would be taken down and either transported directly off site or broken down into smaller components if required.

4.3 Turbine Foundations

It is widely accepted that there is no appreciable effect on the local environment from buried reinforced concrete structures left in-situ due to the inert state of concrete. Therefore the foundations will be reinstated as follows:

- Following the removal of the wind turbine, topsoil and subsoil will be excavated to expose the top of the foundation and set aside for reuse;
- The reinforced concrete foundation will then be broken out to an agreed depth below existing the ground level and the material will be taken up and removed as identified in the site restoration scheme; and
- The excavation will be then backfilled with suitable fill material, covered with topsoil and reseeded as required.

4.4 Control Building and Substation Compound

The control building and substation compound will be decommissioned by disconnecting and dismantling all the surface plant. Solid structures such as the building and equipment plinths will be demolished and the foundation will be removed to an agreed depth below ground level. Ducting and cabling that is within the depth to be cleared will be removed.

The fence surrounding the compound will be removed and the area landscaped so it can revert to its original state.

4.5 Electrical Equipment

The electrical equipment will be decommissioned in the reverse of the installation method involving similar plant. The equipment will be dismantled, removed from site and disposed of in an appropriate manner.

4.5.1 Cabling

Cables will be removed where they are within the depth agreed with the Local Planning Authority. Trenches will be backfilled with material removed during the cable removal process, covered with topsoil and reseeded as required.

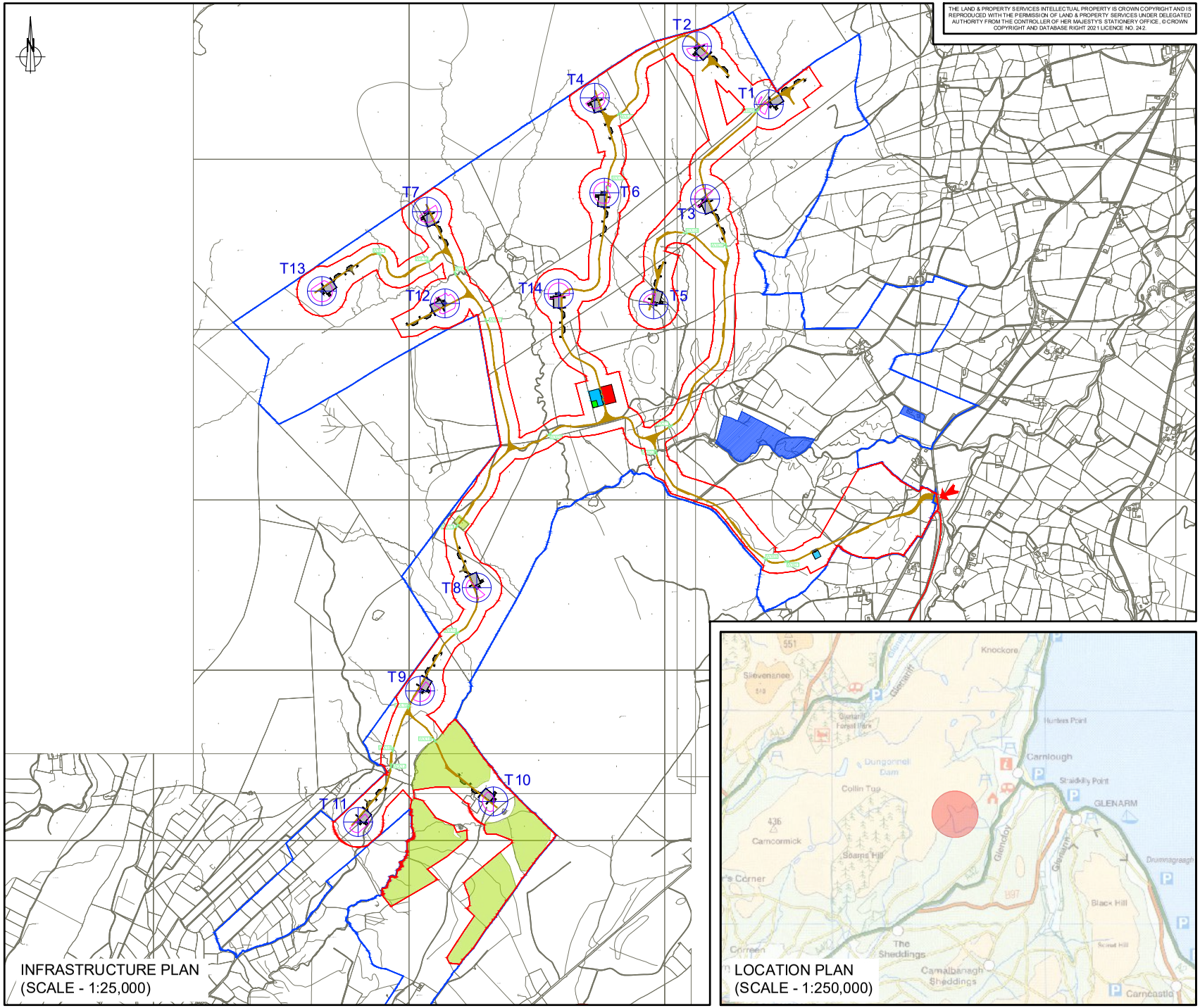
To minimise undue exposure to risks of working on steep slopes, the trenching arrangement and associated infrastructure are to be left in-situ and back filled as required.

In certain situations and in agreement with applicable parties, cables will remain in-situ to avoid any effect to the local environment through their removal.

5.0 RECORDS

Records, as-built drawings, specifications, operational maintenance manuals and residual risks will be collated and filed in the Project Health & Safety file based upon the requirements of the Construction Design and Management Regulations (NI) 2016.

ANNEX 1: DRAWINGS



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UNSHINAGH WIND FARM

FIGURE 1.3

INFRASTRUCTURE LAYOUT

KEY

- PLANNING APPLICATION BOUNDARY
- LAND UNDER APPLICANTS CONTROL
- LAND NOT INCLUDED
- WIND TURBINE LOCATION
- TURBINE MICROSITING
- NEW SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
  - ENERGY STORAGE COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND
- WATERLESS WHEEL WASH
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMANENT HARDSTANDING AREA
- SITE ENTRANCE LOCATION
- FORESTRY TO BE REMOVED

LAYOUT DWG	T-LAYOUT NO.
N/A	PNIRuns024

DRAWING NUMBER
04291-RES-LAY-DR-PE-001

SCALE - AS SHOWN @ A4

ENVIRONMENTAL STATEMENT 2021

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ANNEX 2: SAFETY AND ENVIRONMENTAL REQUIREMENTS OF CONTRACTORS – 01059R00038

Safety and Environmental Requirements for Contractors on all activities (RSWP 005)

Revision History

Issue	Date	Nature and Location of Change
1-13		Previous revision histories to this document can be found in revision 13
14	12/09/15	Document completely redrafted as part of lean review/ FFF process, to incorporate previous departmental 'Safety Requirements' versions and Environmental Requirements of Contractors document. Reviewed extensively by all the UK Geographic Business Units during this process and this document now replaces; RSWP 011 Safety Responsibilities of Contractors Construction (Eire) 01059R00039 RSWP 022 Responsibilities of Contractors Working on RES Offices 01059-000095 RSWP 027 Safety Requirements of Contractors Generation 01059-00065 RSWP 031 Safety Requirements of Contractors Development 01059-001264 Environmental Requirements of Contractors 01226R00016
15	19/08/16	Document title changed by removing RWSP 005 from start and putting at end; Safety & Environmental Requirements for Contractors on all activities (RSWP 005)

CONTENTS

1 PURPOSE

The purpose of this document is to promote; Health, Safety, Environment, Safety Leadership and Sustainability of our Contractors, Consultants, RES employees and the general public by setting out the minimum expectations when working on RES managed contracts.

This document shall be supplied to all Contractors and Consultants tendering for any contracts relating to works or services on any RES site or office, it shall be read carefully and its receipt acknowledged in writing in connection with a specific Contract. No variation shall be permitted without the express permission of the appropriate RES Manager responsible for the works / services; eg. Project Manager, Construction Site Manager, Asset / Site Manager or Office / Facilities Manager, etc.

This document shall be read in conjunction with the relevant Health and Safety (& Environmental – where applicable) Plan for the location of the works.

2 SCOPE

It should be noted that this document and the References quoted below **do not** cover all possible site activities and it therefore remains the Contractor's / Consultant's responsibility to ensure that their works are carried out in a safe and environmentally responsible manner which complies with **ALL relevant legislation current at that time.** All work activities with significant risks are to be covered by an appropriate written risk assessment and work instruction / method statement that has been reviewed by the appropriate RES Manager prior to works commencing.

3 RESPONSIBILITIES & REQUIREMENTS

Contractors & Consultants shall comply with all relevant requirements appertaining to their contracted works. Throughout this document any references to Contractor(s) shall also apply equally to Consultant(s) and whilst RES are not typically identified, this does not absolve RES employees from following the same site rules and requirements as our Contractors or Consultants. Where specific training requirements or qualifications are required, Contractors may provide evidence of alternative training subject to it being equivalent to / better than, the RES defined minimum requirements.

4 RES RESPONSIBILITIES

4.1 Controlling Documentation

RES shall provide the Health, Safety & Environmental Plan (Pre-tender and construction phase), Project Quality Plan and Site Waste Management Plan. RES shall review all Safe Systems of Work for **all significant risk** activities; including Risk Assessments, Method Statements and Permits to Work - **work will not be permitted without these being in place.** HV Electrical cable and system isolations and documentation shall be controlled through RES Senior Authorised Person (SAP) or RES nominated SAP.

RES **shall** audit all aspects of the management of health, safety, quality and environment on site and may carry out appropriate surveys, inspections, tours and sampling at any time. RES may carry out their own accident investigation if deemed necessary to ensure that correct preventative measures are put in place.

4.2 On Site Responsibilities

Safety requirements & rules shall be displayed on site and readily available for all employees to see. RES shall provide the RES site induction or RES on-line induction (to be advised by RES) prior to visiting, starting works & at refresher intervals and provide support to those who have difficulty with the English language to ensure that all site attendees can demonstrate that they understand the site rules & instructions.

RES shall provide prompt information that could affect health & safety of workers, and/or other 3rd parties, members of the public, ensuring adequate steps to prevent harm to livestock on site, maintenance of site fencing, boundaries & keeping gates closed.

RES shall facilitate agreements on interface responsibilities between other parties – within procedures and appropriate documentation controls, including regular meetings / liaison with RES staff, employees and other contractors to identify and discuss hazards with work activities and how they could affect others.

Unaccompanied site visits will be at the discretion of the RES Site Manager. First Aid facilities and provision of first aid is the responsibility of the contractor unless agreed otherwise, RES facilities will be available for use in case of emergency.

4.3 Wildlife

RES Site Manager shall inform Contractors of any constraints or work time restrictions due to the protection of wild life, i.e. nesting sites, habitat issues. If unexpected wildlife is encountered during work activities, i.e. bird nest / badger sett etc, work is to be temporarily suspended and the Site Manager informed. No work shall take place until clearance has been given by RES to resume.

5 CONTRACTOR / CONSULTANT RESPONSIBILITIES & REQUIREMENTS

5.1 Controlling Documentation

Contractors shall provide the Health & Safety management & site controls applicable to employees, visitors, third parties, Quality management & associated documentation for services, equipment, materials, products, Environmental management & associated documentation for services, equipment, materials, products. Contractors shall conform to the Project; Health, Safety (& Environmental) Plan, Quality Plan and Site Waste Management Plan. Contractors shall provide the Inspection & Test Plan appropriate for their works and any associated documentation required to support conformance to contract specification.

Safe Systems of Work for **all significant risk** activities shall be provided, including; Risk Assessments, Method Statements and Permits to Work - **work will not be permitted without these being in place.**

5.2 On Site Responsibilities

Safety requirements & rules shall be displayed on site and be readily available for all employees to see, with delivery of toolbox talk records provided to RES. Contractors shall ensure that all site attendees complete a RES site induction or have undertaken a RES on-line induction (to be advised by RES) prior to visiting, starting works & at refresher intervals – including provision of support to those who have difficulty with the English language; everyone attending site must demonstrate that they understand the site rules & instructions. Contractors shall provide safety training & skills competency records (nationally recognised training bodies) – including matrix of training requirements and supporting certificates, CITB cards etc for all employees.

Contractors shall provide communication devices for contact and emergencies; to suit site requirements (mobile phone signals may not work), provision of prompt information that could affect health & safety of workers, and/or other 3rd parties, members of the public.

Implementing adequate steps to prevent harm to livestock on site, maintenance of site fencing, boundaries & keeping gates closed. A fencing & gates / gated scheme **shall** be developed and agreed with the landowner, including location, temporary or permanent. Agreeing interface responsibilities between other parties, defining within procedures and appropriate documentation controls.

Undertake regular meetings / liaison with RES staff, employees and other contractors to identify and discuss hazards with work activities and how they could affect others. Agreement to start works on site is through the consent of the RES Site Manager. When required, work instructions and risk assessments are to be provided to all employees undertaking the work who fully understand and agree with the requirements. Keep adequate records for site works including nature of work, duration, etc and making available to RES as required.

Visitors to be accompanied on site **at all times** by a fully inducted employee, (visitors shall receive a full induction if visiting site more than once and unaccompanied site visits shall be at the discretion of the Site Manager).

Contractors shall appoint a Competent Safety Representative (responsible for all safety issues for their company inc. electrical safety rules if applicable) and Site Supervisor(s) normally (black coloured hard hat required on construction sites) trained to nationally recognised standards, E.g. SSSTS, IOSH Managing Safely, Black / Gold CITB Card.

5.3 Site Accommodation

Temporary electrical systems are to be designed, inspected & tested by the Contractor, who shall provide the forms of Completion, Inspection & Testing required by the Wiring Regulations BS7671. Housekeeping relating to accommodation, storage and vehicles is to be of a high standard including regular cleaning. Areas for storage of plant, equipment, materials along with rules for use and access are to be in agreement with / designated on site by the RES Site Manager – Contractor shall provide all details of site requirements and what is being used on site (including any reinstatement of area after use).

All access tracks and entry routes are to be kept free of obstacles and well maintained – this includes controlling dust. Petrol or diesel engine plant is not to be used within buildings unless exhaust gases are piped to open air or an alternative approved. LPG is only to be used in accordance with legislation.

5.4 Site Security

Contractors **shall** use designated means of access and egress on the site, daily site records of employees **shall** be collected to aid security in the event of a fire or other emergency. Where security is used on site it **shall** be the duty of the gate / guard person to ensure vehicles and people are logged and have undergone induction.

5.5 Safety Audit(s)

Contractors shall make available all information and records as required by an auditor in the undertaking of their activities. The Contractor **shall** co-operate at all times in the undertaking of such health, safety, quality or environmental related audits and follow up actions. The Contractor **shall** undertake their own audits and inspections as agreed by both parties. Any actions identified from the audits shall be planned, communicated and agreed to rectify the issue(s).

5.6 Alcohol, Drugs & Smoking

The supply and consumption of alcohol & drugs is **prohibited** on site. Any misbehaviour at work such as; being under the influence of alcohol or drugs, shall be classed as gross industrial misconduct. Accident investigation on site may require the need for alcohol or drug tests to be undertaken by the employer.

Any person prescribed medication by their GP must be fit for work. The Site Manager needs to be informed of such instances and arrangements made for storage of their medication on site. A record of their capability for work may also be required.

5.7 First Aid

First aid facilities and provision of first aid is the responsibility of the contractor unless agreed otherwise. All First Aid treatments must be reported and logged, no matter how small. Notification of first aid arrangements **shall** be displayed and employees and other 3rd parties **shall** be informed of the arrangements.

5.8 Accident Reporting & Investigation

All accidents **shall** be reported and recorded in their company and the RES site accident book / recording system. The RES Site Manager **shall** be informed of all accidents, incident and near misses. The RES accident procedure shall be followed. Any notifiable accidents, specified injuries or conditions, or dangerous occurrences which are reported by the contractor under RIDDOR regulations, **shall** be reported without delay to the RES Site Manager.

The Contractor **must** encourage near miss incident and hazard reporting, active recognition and reporting is a key function in Safety Leadership and a mandatory responsibility of everyone on site. The Contractor's Health and Safety Advisor is to carry out a full investigation of all accidents and issue a report to RES.

5.9 Lone Working

A risk assessment **shall** be produced to determine the risks of lone working and to mitigate any risks – lone working should be avoided where possible. Where persons are required to work alone, i.e. surveys, a lone working procedure shall be in place and communicated to all parties. The procedure shall be agreed with the Site / Project Manager.

5.10 Excavations, Barriers & Existing Underground Services

No mechanical excavation work shall take place within one metre of live High Voltage Cables, nor within 500mm of any known live utility services. Contractors shall provide early notice of their intended work near live services, confirming location of underground services and preparing safety document controls, barriers around all opening, trenches, excavations to prevent access into the areas.

Permission to remove / open mesh, coverings, gratings shall be obtained and removed items are to be replaced as soon as possible. Report any broken or damaged gratings etc and put in place controls to prevent any risk of injury etc. Provide all shoring and support to excavations to prevent collapse as per HSG 150.

Excavated materials not suitable for backfill are to be disposed of in accordance with the Site Spoil Management Plan. Drilling, spikes or posts are to not to be driven into the ground without a permit to break ground as issued by the Site Manager.

There must be no alterations to any RES supplied barriers, screens or notices. Warning lights and reflective surfaces **shall** be placed on barriers around excavation works. Inspection reports are t**o be** undertake**n pri**or to entry of excavations, upon completion of shuttering and after additional works, alterations or dismantling as per HSE CIS 47. Weekly inspections are required and ev**idenc**e submitted to RES. Excavation tags to be positioned at all **acce**ss/egress points to all excavations and be updated at each inspection.

Segregation of plant and pedestrians shall be maintained; barriers are to be installed at access points and within excavation, along with appropriate signage. Stop blocks to be used with reversing of vehicles up to an excavation.

Pumps to be used to remove water from excavations shall be regularly inspected for stability; pumped water, whether ground or rain is not to be pumped into a watercourse or drain, water is to be managed in accordance with the site drainage plan (typically settlement lagoons).

5.11 Lifting Operations - Mobile cranes or similar type of equipment & lifting accessories

All lifting operations shall be managed in accordance with BS 7121; which shall include preparation of: risk assessment, method statement and lifting plan; and shall be agreed by all parties prior to works taking place. The lifting plan shall cover crane mobilisation, assembly and travel on site as well as any unloading and lifting activities. All crane movements on site are subject to 'Permit for Movement of Heavy Plant'.

All lifting equipment shall be fully certified and in date; copies of all certification and inspection reports shall be provided to RES prior to the works taking place. Safe Working Load (SWL) shall be clearly marked on **all** lifting equipment and ancillaries, along with test date. Structural steelwork shall not be used for lifting point or anchorage without

agreement of RES (only permitted in exceptional circumstance and has been subject to structural review – Structural Engineer report required).

All temporary points for attachment to be load tested prior to use and record of test provided to RES, method of testing to be agreed. All testing shall be undertaken by an approved Test Engineer to British standards; approved on Lifting Equipment Engineers Association (LEEA) or similar organisation. Persons are not allowed to ride on a hoist unless it has been designed to carry passengers and fitted with interlock gates / safety devices. All persons operating hoists are to be fully trained and have recorded evidence of training to a national recognised standard.

RES lifting operations checklist shall be used unless contractor has their own approved requirements. All crane lifts shall be planned by a competent Appointed Person (AP), an approved Crane Supervisor **MUST** be on site if the AP is not able to monitor the lifting. Lifting plans including method statement / risk assessment shall be reviewed by RES.

5.12 Scaffolding / Ladders

Only competent and fully trained persons **shall** be used to erect, dismantle and modify/alter and inspect scaffolding (CISRS – tube & clip, PASMA – system). All scaffolding **must** display an in date SCAFFTAG or similar signage tag at point of access detailing scaffold status. All scaffolding **shall** be designed, erected, maintained, examined and recorded for the type of scaffold used – where necessary scaffold should be earthed.

All trained scaffold erectors **shall** wear securely attached safety harnesses connected to suitably tested fixed points as appropriate to risk assessment requirements. Scaffold boards **shall** be clamped into place wherever possible; any gaps in scaffold boards **shall** be covered with an appropriate secured material strong enough for the application and activity. Scaffolding **shall** be redesigned for all work activities, adjusted and inspected prior to use for each phase of work, scaffolding is not to be used until it has been cleared for the work activity.

Permission to use a scaffold erected by others must be obtained from the Site Manager and only after an inspection has been carried out. Incomplete and unsafe scaffolding **must** not be used and appropriate measures shall be put in place to prevent usage and when site is unattended access routes to scaffold to be removed to stop persons climbing scaffold.

All ladders used on site **shall** be in good condition and have a system of regular inspection; register to be kept on site. Metal ladders **shall** not be used in the vicinity of electrical equipment or scaffold.

Scaffold inspections **shall** be carried out by a competent person before use and then weekly (7 Days). Inspections will also need to be carried out following any modification or alteration to scaffolding; reports to be provided to RES weekly.

5.13 Work at Height

Any work at height or below ground level activity, **shall** require a method statement & risk assessment and be reviewed by RES prior to starting the work. A safe access & safe work place **shall** be provided via use of crawling boards, ladders, barriers, handrails, toe boards, edge protection as applicable. All materials **shall** be prevented from falling.

Warning notices shall be displayed, along with exclusion zones at all levels, access routes etc.

The Work at Height hierarchy; Avoid, Prevent, Minimise should be implemented; 'collective' protection methods shall take priority to individual personal protection, with fall arrest equipment only being used if all other forms of protection cannot be achieved.

If Fall Arrest is to be used, persons must be fully trained in its use; it shall be inspected before / during use and have appropriate tested attachments; relevant records of equipment tests / dates to be provided. 100% attachment of the equipment is required during working at height, including double lanyards or other fall arrest equipment if collective measures are not implemented, method statement shall include Emergency Plans to rescue a suspended casualty. The Contractor shall inspect all equipment to ensure compatibility between each item being used.

MEWPS, mobile scaffold, podium steps **shall** be used where possible, ladders shall only be used for short duration low risk work, for no more than 30 minutes and only where stability can be achieved.

5.14 Risk & Environmental Controls

Contractors shall identify all potential environmental risks and report to the Site Manager, inform all employees of the site environmental rules and inform RES of environmental incident or potential incident as soon as practicable. Provision of information to RES for carbon counting / sustainability targets and records, typically: vehicles on site, mileage covered, fuel used (site equipment), materials used, visitors and travel details, etc.

5.15 Environmental Plan

Contractors will be required to provide relevant documentation for inclusion into the RES Environmental Plan when applicable, all contractors are to comply with the RES Environmental Plan at all times.

5.16 Existing Features (Sites)

Any disturbance, remediation or disposal of contaminated land shall only be carried out under the direction of RES and in accordance with the Health, Safety (and Environmental) Plan, areas of contaminated land **shall** be fenced off and all persons made aware of its location and hazardous nature. Where any unexpected or potential hazardous obstacles are encountered, work **shall** cease until specialist advice has been obtained.

Underground services **shall** be identified in the site Health, Safety (and Environmental) Plan and controls put in place for the works to be undertaken, i.e. permit to work, risk assessment, etc. If poor conditions of underground services are found after exposure, this is to be reported to RES and the relevant authority.

Any old containers found on site should be checked and emptied by a licensed waste carrier before removal. Pollution is often caused through vandalism, theft or fly tipping – the site or working area **shall** be protected by fencing and locked access to discourage unauthorised access. Any instances of tipping on site **shall** be reported to the Site Manager.

5.17 Discharges to Water

All employees **shall** be made aware of the following:

- Rules about discharges to drains from spillage
- Refuelling / storage controls to be in place & location to be away from surface drains (minimum 10m distance)
- Use of bunded areas / bunds, double skinned bowsers for storing of fuels, liquids etc – to be checked weekly
- Management of any / all spills, spill kits, informing Site Manager etc (included in risk assessment)
- Discharge of any fuel, chemicals, silt, etc to a drain or water course is forbidden. Ensure that a suitable method for containing any surface water is provided when working near to a watercourse
- Surface water drains should only carry uncontaminated rain water and shall be protected from any other contaminants
  Methods for prevention of pollution to water courses shall be regularly checked and maintained – failing of systems should be reported immediately to RES.

5.18 Hazardous Substances (COSHH)

Contractor shall provide a list of substances, liquids, gases, etc to be used on site or with their work activities, along with quantities to be stored in secure storage containers, clearly labelled with legible warning signs and content details. MSDS & COSHH Risk Assessment & register and controls in place, including emergency plans.

As defined by COSHH Risk Assessment, spill kits are to be located near any hazardous liquids or substances either at point of use or storage area. Emergency procedures and associated equipment shall be provided – 'Kelp' bio-remediation solution shall be provided for early treatment of any spills after initial clean up.

Generators **shall** be provided with an internal bund and external fuel tank with fuel cut off float switch, the refuelling area shall be kept empty of water (covered area or inceptor/full retention separator).

Bowsers are to be stored to minimise risk of collision, run-away and vandalism, with a flexible pipe, tap or valve provided with an appropriate lock for security when not in use. Flexibly delivery pipes for use with refuelling must be fitted with manually operated pumps or a valve that closes automatically when not in use (delivery end).

Fuel type and capacity shall be displayed, along with no smoking signs and close valve when not in use signs, etc. A responsible person **shall** supervise deliveries, check tank quantities and emptying of tank and residues for safe disposal elsewhere.

Switch gear containing SF6 (Sulphur Hexafloride) **shall** be labelled on the equipment and substation door, along with contractor details and any leak **shall** be reported to the Site Manager and acted upon following the emergency contamination spill procedure.

5.19 Waste Management

Waste management **shall** follow the waste hierarchy of: Prevent, Reduce, Re-use, Re-cycle, Other recovery before disposal, all wastes shall be stored and segregated at designated disposal points away from watercourses and potential risk areas (cleared from work area as it is accumulated).

All personnel are to prevent litter from being blown around the site by disposing of rubbish responsibly. Skips must be covered to prevent refuse blowing away and rainwater accumulation. Skips to be replaced when full and disposal shall be in accordance with statutory requirements and RES Site Waste Management Plan, Contractors shall provide appropriate waste documentation.

5.20 Earthworks

Contractors shall work to the site drainage / SuDS design statement for the site. Appropriate drainage / SuDS management methods shall be agreed with the Site Manager where no Construction Method Statement is present.

Contractors shall make best endeavours to prevent water becoming contaminated at the place of work, activity area and to prevent build up of silt; shall use methods of work that eliminate or reduce workings in channels and do not contaminate surface water. Water containing silt **shall** not be discharged directly into rivers, streams or surface water drains. If silty water does occur and present a hazard, suitable treatment will be required – details of controls to be presented to the Site Manager.

Contractor shall prevent water from entering excavations, any cut-off ditches, well point de-watering or pumping shall be in accordance with the site drainage plan. Disturbance to flora and fauna whilst carrying out works **shall** be kept to the minimum and agreed with the Site Manager.

Topsoil and vegetation (not part of subsoil) **shall** be retained and stored in accordance with the Site Spoil Management Plan and reinstated on all areas of stripped ground as soon as possible to prevent erosion and leaching.

Where wet and marshy ground occurs, excavated materials may need to be stored on a geotextile. Turf shall be reinstated wherever possible to maintain the original species mix. Exposed ground and stockpiles / storage shall be kept to the minimum to prevent silt and dust build up, whilst long term storage shall be controlled and stockpiles seeded with recovered seed, covered and silt fences constructed from geotextile where required. In dry weather dust suppression controls will be required to eliminate at source, e.g. watering.

Environmental Agency guidance shall be used as guidance in control measure for works and maintenance in or near water.

5.21 Road Cleanliness

Site roads to be brushed or scraped as required to minimise mud and dust deposits, especially at site entrances and watercourse crossings; mechanical suction brush may be necessary. Wheel wash stations may be required to mitigate debris going onto public highways, private roads or accesses. Used water shall be collected and passed through a silt trap before disposal.

5.22 Drip Trays

Where practicable, drip trays shall be used to contain absorbent granules, sheets or fibres and disposed of to site rules. Once used, drip trays shall be cleaned using

appropriate materials and disposed of in accordance with COSHH regulations. Regular checks and cleaning of drip trays to be carried out.

5.23 Concrete

All concrete disposal shall be as set out in the Site Waste Management Plan (SWMP) when in place or responsibly and in accordance with legislation when no SWMP in place. Cement and wash out water is not to enter any watercourse or aquifer; wash out of cement vehicles **shall** only be permitted in a designated and suitable prepared wash out area(s), clearly signed and to the satisfaction of the RES Site Manager.

Tools, equipment or materials shall not be washed in watercourses, mortar mixing and storage shall be clear of any watercourses. Any concrete works near to a watercourse shall be approved by the appropriate agency and the RES Site Manager.

5.24 Wildlife

Wildlife **shall** be protected from entering and becoming trapped in any part of the works on site. For excavations this may mean provision of fences, crossing or escape routes. Due consideration shall be given to hazards presented to personnel from wildlife; adders, wild boar, buzzards, wasps etc.

5.25 Emergencies

Environmental emergencies such as spills **shall** be dealt with in accordance with the Environmental Emergency Response Plan – familiarisation with this plan is required before commencement of any works. Any spill kit provided **shall** be made accessible at all times to all site staff.

5.26 Environmental Assessment

Contractor shall provide an assessment of the likely environmental impacts of their activities (if applicable), along with controls to minimise impact and any corrective measures and actions.

6 APPENDICES

Appendix 1 – References

Appendix 2 – Issue / Receipt for Safety and Environmental Requirements for Contractors on all activities

Appendix 1 - RES References

The following documents may contain useful references.

App 1.1 RES Documents

i) RES Health, Safety, Quality & Environmental Management Systems, and associated documentation including all IMS, Safety Procedures, RAWP and documents and templates

App 1.2 Project Specific Documents

i) The Health, Safety & Environment Plan (Pre-tender and construction phase)

ii) Health & Safety Plan

iii) Quality Plan

iv) Environmental Plan

v) Inspection and Test Plan

vi) Site Waste Management Plan

Appendix 2 - Issue / Receipt for Issue / Receipt for Safety and Environmental Requirements for Contractors on all activities

SAFETY & ENVIRONMENTAL REQUIREMENTS FOR ALL CONTRACTORS

ISSUE DOCUMENT

Issued to .....

Contract Number and Description
.....

.....
...

.....
...

Location
.....

The person named below is the Company Project Manager responsible for overall management of the contract.

Project Manager ..... Telephone
.....

The person named below is the Company Site / Facilities Manager responsible for local management of the contract, who shall be permanently on Location.

Site Manager ..... Mobile
.....

Other Site Telephones
.....

The Site Manager shall always be the first point of contact, if for any reason, he is not available you shall contact the Company Project Manager.

The Company Integrated Management System and Site Rules are available / displayed at:

.....
.

SAFETY & ENVIRONMENTAL REQUIREMENTS FOR ALL CONTRACTORS

RECEIPT DOCUMENT

RENEWABLE ENERGY SYSTEMS COPY

(To be detached and retained by the Site Manager when this document is issued to a Contractor on site)

I acknowledge receipt of the safe works procedure - Safety & Environmental Requirements for All Contractors.

Contract Number and Description
.....

.....
...

.....
..

Location
.....

Signed .....

Contracting Company
.....

Date .....

Contracting Company Head Office Telephone
.....

Local/site Telephone Number .....

ANNEX 3: FLOOD RISK & DRAINAGE ASSESSMENT

(SEE Vol 4, Section 9 of the ES)

ANNEX 4: PROCEDURE IN THE EVENT OF A CONTAMINANT SPILL

Emergency Procedure in the Event of a Contaminant Spillage

CONTENTS

1.0 OBJECTIVES

This procedure details the emergency procedure to be followed and actions to be taken in the event of a hazardous waste spillage such as oil, fuel and chemicals, occurring on a RES managed premises or site / project in order that the environmental impacts that may be associated with a hazardous waste spillage may be mitigated.

2.0 SCOPE

This procedure covers all UK geographic locations; sites, project or offices for which RES are responsible for or manage.

3.0 PROCEDURE

3.1 Project, Site or Office Locations

		Responsibility
i)	The Contractor shall provide MSDS and COSHH assessments for all substances controlled under COSHH that are to be used or stored on the site. Records of the supplied MSDS & CoSHH Assessments shall be maintained. Note: Substances with hazardous properties such as cement, concrete and curing agents are all controlled by the COSHH.	**C**
ii)	Appropriately sized spill kits shall be provided for the controlled substances that will be used or stored on the site; the contractor shall train personnel in the use of these spill kits and maintain training records.	**C** **RRM**
iii)	The Contractor shall provide oil spill training and awareness to their staff RES have subscribed to an emergency environmental call-off support service from Veolia to be used the event of a major spill, details included in Project Directory or can be provided by the HSQEM.	**C,** **HSQEM**
iv)	In the event of a liquid spill occurring the Contractor shall cease work in the vicinity immediately. If spillage is flammable, extinguish all ignition sources. Identify source of pollution and rectify the problem. The Contractor's trained personnel shall immediately deploy the spill kit in accordance with the manufacturer's instructions. Contractor's personnel shall don appropriate PPE and clean up the spill. All used spill kit materials should be disposed of in the proper manner.	**C**

v)	In the event of a concrete spillage into water channel or surface water, as the waste is highly alkaline it is regarded as Hazardous Waste. Every effort should be made to contain the movement of the liquid cement in the watercourse or drainage channel. Similarly in the event of a Peat / Spoil Movement / Slip into a water course; remove any peat or clay material which has entered the watercourse and transport to a location where it will no longer be a source of pollution. Notify the following agencies; Environmental Agency (region specific; EA, SEPA or NIEA etc), local Fisheries.	**RRM, C**
vi)	Place geotextile silt fences/stone barrages at downstream points in the river as required. Constant monitoring should be maintained not only of the water quality (clarity) downstream of the check dams, but also of the excavated peat or clay material. Consideration should also be given to the subsequent movement of the spoil / peat and any preventative / containment measures required.	**RRM**
vii)	The Contractor shall inform the RRM of the incident as soon as possible and certainly no more than 1 hour after the spill.	**C**
viii)	The Contractor is responsible for replacing the used spill kits as soon as possible and no later than 24 hours after use.	**C**
ix)	The Contractor is responsible for ensuring that used spill kits and any other oil / fuel soaked / contaminated material e.g. rags, used during the incident are disposed of in accordance with the Environmental Waste Management Regulations in operation. These materials shall be bagged up, and disposed of at a licensed hazardous waste disposal site e.g. taken away by a licensed oil / fuel disposal / broker company.	**C**
x)	The Contractor shall submit copies of the receipt or waste oil certificate to the RRM within 48 hours.	**C**

4.0 REFERENCE DOCUMENTS

i) IMS 20 – Emergency Incident Preparedness and Response HSQE00-001043

5.0 DEFINITIONS

	Abbreviation or term	Explanation of abbreviation or term
i)	C	Contractor: Any company or person employed by RES to carry out any work on a site / project or office location
ii)	COSHH	Control of Substance Hazardous to Health Regulations 2011
iii)	H&S Plan	Health and Safety File maintained by the Site Manager
iv)	HSQE	Health, Safety, Quality & Environment
v)	HSQEM	HSQE Manager (Head of HSQE)
vi)	MSDS	Material Safety Data Sheet supplied by manufacturer
viii)	RRM	Responsible RES Manager (Construction Site – Construction Site Manager, Generation Site – Site / Asset Manager, Office Locations – Office Manager)

ANNEX 5: SPOIL MANAGEMENT PLAN

Unshinagh Wind Farm

Peat Management Plan

27 September 2021

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Client Confidential

Renewable Energy Systems Limited

Document history

Author	Sam Fisher, Geotechnical Engineer	27/09/2021
Approved	Gavin Germaine, Principal Geotechnical Engineer	27/09/2021

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Issue	Date	Revision Details
A1	27/09/2021	First Issue
B1	18/01/2021	Second Issue: Updated site layout.

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Contents

1. Introduction

The Peat Management Plan (PMP) provides information and guidance on the environmentally compliant re-use and management of excavated peat across the proposed Unshinagh Wind Farm (the Proposed Development).

The study has drawn on information collected as part of peat assessment including a desk study followed by a phase one then phase two detailed peat probing exercise. The PMP; estimates the volumes of excavated peat likely to be produced by the Proposed Development and outlines suitable reuse methods in line with regulatory requirements and best practice.

This strategy should be adopted to ensure peat is managed in a sustainable manner, minimising excavation via the adoption of appropriate construction methods. Targeted re-use of peat as part of the reinstatement works should be a primary consideration.

Report Author: - Sam Fisher is a Geotechnical Engineer at Natural Power and engineering geologist by training (MSc Engineering Geology) with greater than 5 years of relevant geotechnical experience. Sam has completed multiple peat management plans for wind energy projects across the UK.

Report Authoriser: – Gavin Germaine is a Principal Geotechnical Engineer at Natural Power and engineering geologist by training (MSc Engineering Geology) with greater than 12 years of relevant geotechnical experience. Gavin is a chartered Geologist and a Fellow of the Geological Society of London. Over the last decade has completed multiple peat assessments for wind energy projects across the UK and Ireland. Gavin has further provided expert technical advice as part of planning enquiries and being part of an international team examining new geotechnical investigation techniques for in-situ testing and sampling of peat.

1.1. Regulatory Requirements

This document addresses the following requirements in line with statutory guidance of the UK:

- **Prevention** – The best management option for waste peat is to prevent its production; and
- **Re-use** – Developers should target re-use as much of the peat produced on site as possible.

The following guidance has informed design assumptions and subsequent selection of appropriate construction methods based on the distribution of peat across the proposed development:

- Developments on Peatland: Guidance on the assessment of peat volumes, re-use of excavated peat and the minimisation of waste (A joint publication by Scottish Renewables, Scottish Natural Heritage (SNH), SEPA, Forestry Commission Scotland, 2012);
- Floating Roads on Peat (Forestry Civil Engineering & SNH, 2010); and
- Good Practice During Wind Farm Construction (A joint publication by Scottish Renewables, SNH, SEPA, Forestry Commission Scotland, 2019), Version 4.

1.2. Limitations

The information presented in this report is based on the results of peat surveys carried out by Natural Power in March 2021. In addition, detailed probing has been subsequently undertaken in September 2021 following a confirmed site layout design.

This peat management plan has been updated January 2021 to reflect minor changes to the site layout. Infrastructure has predominantly been sited to avoid the deepest areas of peat. Most notably Turbine 14 is now out-with an area of peat.

It is highlighted that whilst attempts have been made to collect peat depth and condition information, further investigations should be carried out as part of detailed site investigation (pre-construction). This process will provide further detailed design information across all infrastructure locations, which should be used to refine the peat excavation and reuse volumes provided in this report.

The PMP should be considered as a 'live' document throughout the planning and any future pre-construction phases of works. As such, additional information can be incorporated following the results of detailed site investigations carried out prior to construction as well as from any discussions with Northern Ireland Environment Agency (NIEA) or other engaged stakeholders throughout the development process.

2. Site Context

The following section presents a summary of the development including hydrological and topographical information. This report should be read in conjunction with the Peat Slide Risk Assessment (Doc No. 1262630) that provides further assessment of peat stability conditions across the site.

2.1. Description of Development

The development will comprise of up to 14No. wind turbine generators. Wind farm infrastructure will also be required in the form of external wind turbine transformer housings, crane hardstand areas, electrical substation, underground electricity cables between the turbines, access tracks, water crossings and drainage attenuation measures as necessary.

The Proposed Development occupies a 5.5km^2 area situated 3.5km southwest of Carnlough, Co Antrim Northern Ireland. Figure 2.1 shows the regional setting of the site and Figure 2.2 shows the site layout.

Source: Natural Power, Google Hybrid Sattelite Image

Figure 2.1: Regional Setting

Source: Site Boundary and Turbine coordinates supplied by RES, ESRI World Topo.

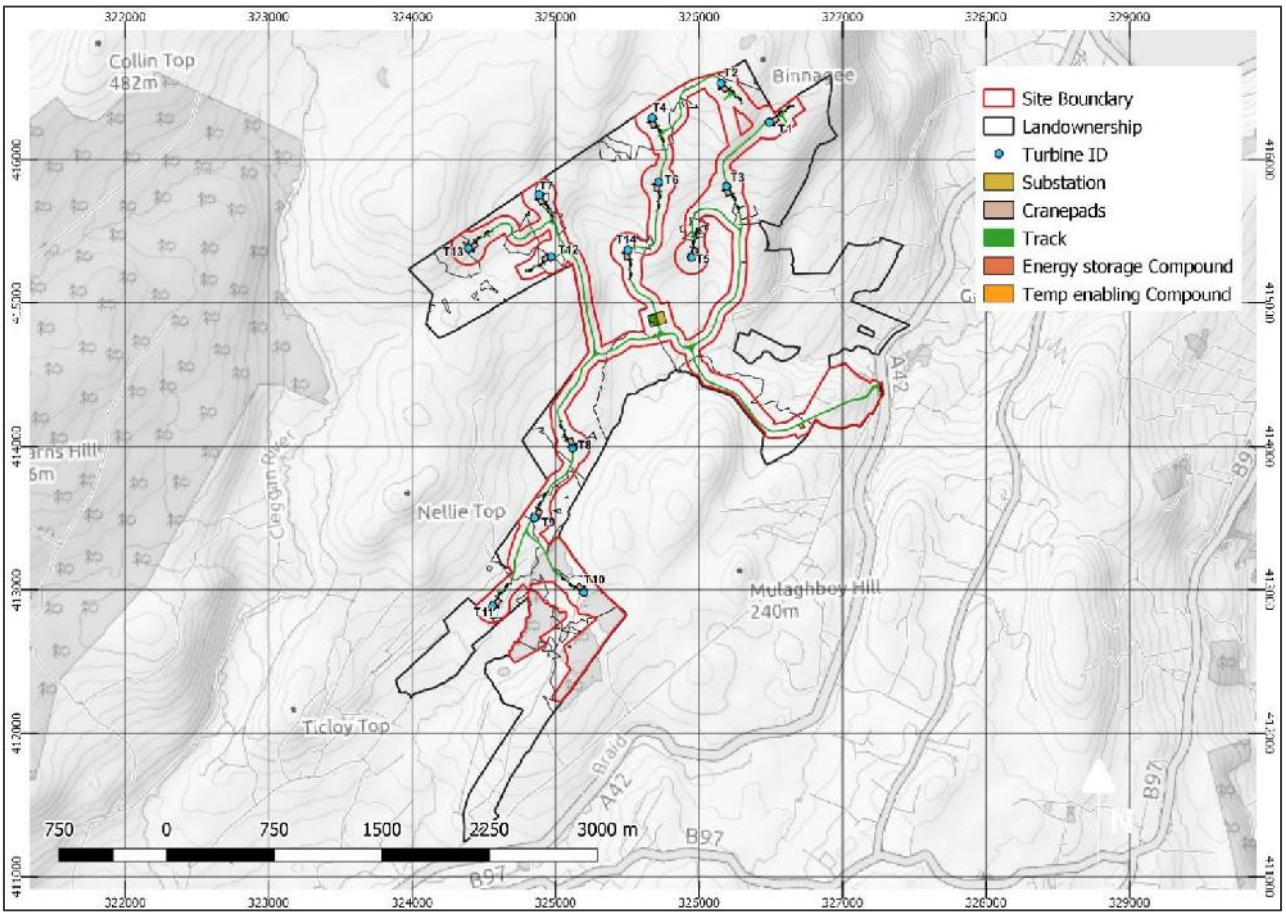

Figure 2.2: Site Layout

2.2. Hydrology

The Northern Ireland Department for Infrastructure Flood Maps; does not show any significant flooding potential across the proposed development. Small tributary streams at 400-500m intervals run down the main site area. These feed into an unnamed tributary of the Glen Cloy River, at and east of Carrigvohil Loughs, flowing east. The Ticloy Water flows west from Carrigvohil Loughs.

Minor surface water occurrences are disseminated across the site, generally in small topographical depressions and near existing loughs. Artificial drains are present in the first part of the southwestern access route. This could show that the area has been drained to allow for the forestry plantations and farming.

2.3. Soils and Peat

The generalised soil type according to the Soils of Northern Ireland Map within the Proposed Development is ‘Leotosols’, this is categorised as soils with a very shallow profile depth, typically gravelly. This is in line with the peat surveys conducted on site that indicate soil depths predominantly less than 0.50m.

Glacial Till is identified on the GSNI 1:50,000 superficial geology map across the site alongside localised occurrences of peat.

2.4. Hydrogeology

The proposed development is primarily underlain by tertiary basalts, with a portion of the eastern access track underlain by Chalk and Hibernian Greensands. The tertiary basalts underlying the main development are classified by the BGS as a locally important aquifer, with yields ranging from 0.5 to 20 L/s with typical rates around 5 to 10 L/s. ground water movement is confined to fractures within the rock, rather than intergranular flow.

The Chalk and Hiberian Greensand under the basalts are classified as highly productive aquifers (not extensive), which is a regionally important aquifer up to 150m thick. Due to the karstic characteristics of the limestones, the flow is confined to relatively large, fractured pathways allowing yields at springs of up to 32 L/s, yields in boreholes are typically less, around 5 L/s.

3. Peat Survey Results

Peat depth information has been collated to support the volumetric calculations provided in this peat management plan. This data has subsequently been used to minimise any potential impact on the peatland environment.

Investigations were undertaken to ensure a high resolution and focussed assessment maximises the understanding of the impacts of the project on the local peatland environment by improving the efficacy of the volumetric calculations provided in this document. The completion of a focussed assessment also provides the greatest opportunity to microsite infrastructure away from areas of deeper peat.

Peat deposits can exist in one of three forms:

- **Fibrous** – non-plastic with a firm structure and is only slightly altered by decomposition;
- **Pseudo-fibrous** – peat in this form still has a fibrous appearance but is much softer and more plastic than fibrous peat. The change is due to more prolonged sub-mergence in airless water rather than to decomposition; and
- **Amorphous** – decomposition has destroyed the original fibrous vegetation structure such that it has virtually become organic clay.

Peat deposits can also be characterised into two layers:

- The '**acrotelm**' is the upper layer and has a relatively high hydraulic conductivity and therefore has variable water content. This layer comprises of a thin surface layer of active vegetation; and
- The '**catotelm**' is the lower layer, permanently below the water table, which has a small hydraulic conductivity and is often at a higher state of humification and lower tensile capacity.

In total; 1,195 locations were surveyed for peat depth across the Proposed Development. The surveys consisted of Phase I peat depth investigations within the site boundary across a 100m grid. A Phase II survey with 50 m centrelines and 10m offset of tracks and 20m grid across turbines. Surveys also included the collection of peat cores at selected turbines with deeper peat and geotechnical information at all turbines and other key infrastructure locations.

Table 3.1**Error! Reference source not found.** provides a summary of the peat depths recorded and an interpolated peat depth map Figure 3.1 depicts the distribution of peat depths in relation to infrastructure elements and the site boundary.

Table 3.1: Peat Survey Data

Peat Depth (m)	Number of probes	% (Of total)
0.0m < x ≤ 0.5m	801	67%
0.5m < x ≤ 1.0m	253	21%
1.0m < x ≤ 2.0m	114	10%
2.0m < x ≤ 3.0m	20	2%
> 3.0m	7	>1%

Source: Natural Power Phase I and II Peat Survey Data

The peat probe depths show agreement with the BGS data for extent of peat, showing discrete pockets of deep peat at sporadic locations. The deepest pockets of peat in excess of 5.0m have been avoided in the current design layout. The deepest recorded peat during the Phase II survey is east of Turbine 12 to a maximum depth of 2.90m.

The majority of the site has no peat or depths below 0.5m. Peat core samples undertaken across the site have shown that the peat probe can be pushed into very soft clays giving possible overestimated peat depths at some locations. For this reason, turbines with probing depths less than 0.50m are considered to not be peat and have been excluded from the final peat excavation calculations.

Source: Natural Power, ESRI World Topo.

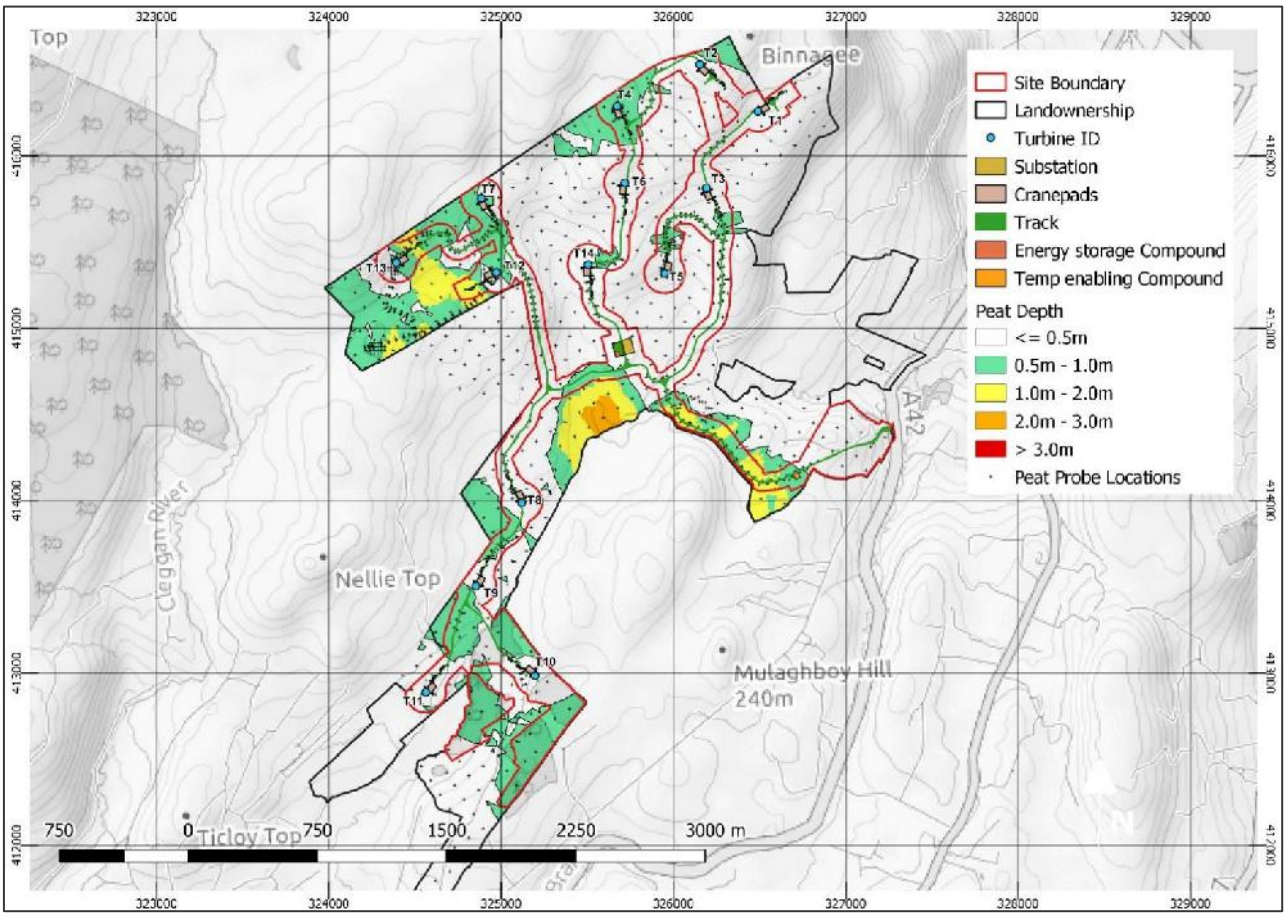

Figure 3.1: Interpolated Peat Depth Map

4. Peat Excavation and Re-use

In order to quantify the volume of peat that may be excavated and re-used across the Proposed Development, the proposed wind farm layout has been analysed using the comprehensive peat depth dataset. The proposed 14 wind turbine layout has been appraised in order to obtain a preliminary estimate of the size and extent of the infrastructure footprint.

The volumetric analysis of excavated peat volumes incorporates the mean peat depths recorded across each infrastructure element. Average peat depths have been assessed based on relevant interpolated data points.

The estimation of peat excavation and re-use volumes relies on a series of design assumptions that may vary on a small scale according to discrete changes in ground conditions. Therefore, it should be highlighted that the peat volume estimates stated in this report are a preliminary indication only.

Volumetric calculations should be re-evaluated when more detailed intrusive site investigation data becomes available. Design assumptions for the access track construction methods have also been taken. The design of the detailed site layout should be confirmed with a comprehensive site investigation.

4.1. Design Assumptions

Excavation & Replacement

Excavate and replacement ('cut') type construction of tracks, passing places, turning areas and crane pads are proposed where peat depths are consistently shallower than 1.0 m, along sections of access track and/or where gradients are in excess of 1:10. This type of construction may also be adopted where there are cross slopes to be negotiated. The cut and fill construction method require the removal of soils down to a suitable sub-grade layer within the superficial or bedrock geology. Excavated soils are then reinstated carefully along access track landscaped verges on either side of the track or utilised in appropriate landscaping across the development infrastructure.

Excavate and replacement track construction sequences shall be designed in accordance with local ground conditions and following a detailed site investigation. A general good practice construction sequence has been provided below and has been adapted and informed by best practice guidance:

1. The route of the cut / fill access track shall be marked out on the ground well ahead of the construction activity. This will allow for advanced checks of any newly developed or unforeseen constraints;
2. As part of this process, the most sensitive sections of the access track route shall be defined. This will include water crossings and steep slopes. These defined zones shall become established management zones where specific mitigation measures and construction techniques shall be implemented to minimise impacts during the construction phase;
3. Where possible, the construction of the cut tracks shall avoid periods of wet weather (when peat deposits are particularly susceptible to deformation and when there is an increased risk of run-off carrying unacceptable levels of sediment. Similarly, the construction of access tracks shall, where possible, avoid periods of very dry weather; when there is a high risk of excavated and exposed peat soils drying out;
4. The cut access track construction shall typically proceed in an uphill direction, thus allowing drainage to be managed with a greater degree of control. The access track side and cut-off ditches shall generally be constructed first. It shall be ensured that these discharge to a suitable buffered watercourse in line with hydrological assessment and relevant drainage controls. It shall be important to ensure that surface water run-off is directed away from the track formation layer. This will act to reduce disturbance by the prevention of water-logging and erosion;
5. A progressive construction method shall typically be adopted whereby the cut track is excavated to a suitable formation and up-filled to the track running surface. Following this, the newly constructed track verges will be restored with peat and vegetation from the next advancing section of track under construction. The sequence of

excavation, up-fill and restoration will be managed to minimise the time between excavation and restoration as far as is practicable; and

6. Plant machinery shall work where practicable from the section of access track most recently completed. The re-use of peat turves and peat from newly excavated sections onto the verges of the most recently completed section of track will act to reduce the overall disturbance of excavated peat. Excavators with long reach arms are also beneficial in reducing vehicle manoeuvres over peat deposits.

Floating Construction

Floating construction of tracks, passing places and turning areas is proposed where peat depths are consistently deeper than 1.0 m and where slope geometry is acceptable. An example construction sequence for floating roads is provided below. This sequence of construction may need to be adapted to localised ground conditions, which may only become fully evident following a detailed site investigation:

1. Mark out the alignment of the road and install advance drainage ahead of construction where necessary;
2. Clear the intended floating road area of major protrusions such as rocks, trees, and scrub vegetation down to ground level leaving any residual stumps and roots in place;
3. Leave the local surface vegetation and soils in place if possible. In many cases the existing vegetation and root system may be the strongest layer in the soil system providing increased tensile strength at surface, and care shall be taken to preserve the integrity of this layer;
4. Any local hollows or depressions along the route alignment shall be infilled with a suitable lightweight fill such as tree brash, logs or a combination of lightweight fill and suitable materials. Similarly, a brash mat and fascines (bundles of brash material) may be adopted to form the initial surface across uneven ground surface;
5. Broken vegetation surfaces such as peat hags and very wet areas with high fines content, may need to be covered with a separator grade geo-membrane to prevent contamination of the aggregate layers. This geotextile may be covered with a thin regulating layer of aggregate prior to installing the main geo-grid;
6. Geo-grids are placed by hand along the alignment of the road, directly onto the prepared area with a simple overlapping arrangement generally in accordance with the relevant manufacturer's specification. A minimum transverse overlap is normally set at 400 mm. However, this may need to be increased depending on the amount of displacement and transverse tension caused by un-even terrain. This should be specified by the geo-grid manufacturer;
7. Place the first layer of aggregate material onto the geo-grid, this shall be a suitable 'well graded material' that will be able to achieve a sound interlock with the geo-grid. The final specification of the aggregate grading shall be dictated by the chosen geo-grid mesh size. Care shall always be taken to avoid damage to the geo-grids; and

The degree of compaction required will be dictated by the local ground conditions along the route alignment. Across exceptionally soft areas of peat there may be a requirement not to apply mechanical vibratory compaction and instead rely on compaction of aggregate through trafficking of wheels and tracks of the construction plant alone.

Access Track Dimensions

Proposed new cut and floating access tracks have been assumed to accommodate a 5m running width, with drainage making up an additional 2m, giving a total width of 7 m. The peat volume calculations have assumed a 7m wide access track excavation with a batter angle of 45º to the excavation sides. This geometry includes the additional width of 1 m along either side of the track to accommodate drainage and cabling. See Figure 4.1 for the access track geometry used for the cut track peat volume calculations. All peat excavated outside of the 7m total width is to be reinstated or used to profile the track and so Is not considered waste.

Electrical cabling is typically laid in trenches (0.5 m width) adjacent to the access track network, which requires excavation, laying and backfilling. Peat generated from cable trenching is normally replaced at its point of origin and is therefore not considered as an excavation loss.

Source: Natural Power

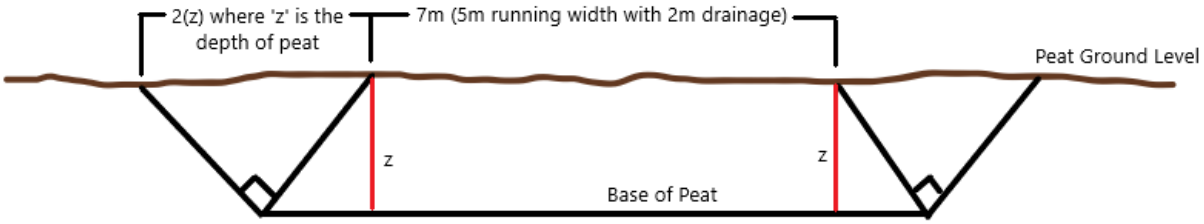

Figure 4.1: 'Cut' access track dimensions used for volume estimate

Turbine Foundations

During turbine construction, peat is generated by excavation to the sub-soil formation to accommodate the concrete foundation and for a working area surrounding the foundation footprint. The surface working area of the wind turbine foundation excavation has been assumed to be 20 x 20 m square excavation (Total excavation areas will therefore be 400m^2) into which a reinforced concrete gravity base will be constructed, this is considered an over estimation of the actual excavation size.

It should be noted that although excavation areas for crane pad areas and foundations will likely overlap, to provide a conservative assessment, peat volumes are calculated for both areas separately.

Crane Pads and Hardstands

The hardstand will be 35m in width and 55 m in length equating to a permanent land take of 1,925 m^2 and is the value which is used for excavation volume calculation. Additional excavation will be required for laydown areas. which are not included as part of this assessment as these areas will typically be of a floated type of construction without the need for excavation.

Additional and Ancillary Infrastructure

The proposed ancillary infrastructure associated with the Proposed Development consists of the electrical substation and temporary construction compound.

The estimations of the excavated peat volumes and any subsequent reinstatement have been calculated based on the design information available at the time of writing:

- 1 x Substation Compound: 25m x 56m (1,400m^2);
- 1 x Construction Compound: 50m x 80m (4,000m^2).

4.2. Excavation Volumes

The estimate of excavated peat volume has been completed following a desk-based appraisal of the proposed wind farm layout supplemented by digital terrain analysis. There has been further refined spatial analysis of the peat depth data set using 'GIS' software analysis. Peat is an organic soil which contains more than 60 per cent of organic matter and exceeds 50 centimetres in thickness. Therefore, for the purposes of these calculations, and because of the information collected on site, probe depths recorded to be less than 0.5 m are defined as not peat. Depths recorded to be greater than 0.5 m are peat, with the upper 0.30 m being acrotelmic peat and depths beyond 0.30 m considered to be catotelmic peat based on peat cores undertaken in the Phase II peat survey.

The following sequence of Tables (4.1**Error! Reference source not found.** to 4.5) provides a summary of the indicative peat extraction volume for each infrastructure element. All total volumes are stated to the nearest 100m^3.

Table 4.1: Turbine Foundation Peat Excavation Volumes

Turbine ID	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
T1	0.00	0	0	0
T2	0.30	0	0	0
T3	0.25	0	0	0
T4	0.28	0	0	0
T5	0.10	0	0	0
T6	0.20	0	0	0
T7	0.00	0	0	0
T8	0.30	0	0	0
T9	0.40	0	0	0
T10	0.00	0	0	0
T11	0.20	0	0	0
T12	0.40	0	0	0
T13	0.60	120	120	240
T14	0.25	0	0	0
Total Peat Extraction		**100**	**100**	**200**

Source: Natural Power

Table 4.2: Crane Hardstanding Peat Excavation Volumes

Turbine ID	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
T1	0.00	0	0	0
T2	0.30	0	0	0
T3	0.25	0	0	0
T4	0.70	578	770	1348
T5	0.20	0	0	0
T6	0.20	0	0	0
T7	0.00	0	0	0
T8	0.30	0	0	0
T9	0.40	0	0	0
T10	0.00	0	0	0
T11	0.20	0	0	0
T12	0.45	0	0	0
T13	0.50	0	0	0
T14	0.25	0	0	0
Total Peat Extraction		**600**	**800**	**1,400**

Source: Natural Power

Table 4.3: Access Track Peat Excavation Volumes

Track Details	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
T1 to T3	0.10	0	0	0
T5 Spur	0.40	0	0	0
SE Access	0.80	6,120	10,200	16,320
T3 to SE Junction	0.40	0	0	0
T2 to T4	0.40	0	0	0
T3 to T6	0.00	0	0	0
Substation to T14	0.10	0	0	0
T14 to T6	0.10	0	0	0
T7 to T13	0.70	2,499	3,332	5,831
T12 to Track Junction	0.30	0	0	0
SE Junction to T8	0.30	0	0	0
T8 to T9	0.50	0	0	0
T9 to T10	0.40	0	0	0
T11 Spur	0.65	1,440	1,680	3,120
SW Entrance	0.10	0	0	0
Total Peat Extraction		**10,100**	**15,200**	**25,300**

Source: Natural Power

Table 4.4: Ancillary Infrastructure

Structure	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
Substation	0.00	0	0	0
Construction Compound	0.00	0	0	0
Total Peat Extraction		**0**	**0**	**0**

Source: Natural Power

Table 4.5: Total Peat Extraction (Indicative) Site Wide

Structure	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
	Acrotelmic Peat	Catotelmic Peat	
Wind Turbine Foundations	100	100	200
Crane Hardstands	600	800	1,400
Access Tracks	10,100	15,200	25,300
Ancillary Infrastructure	0	0	0
Total Peat Extraction	**10,800**	**16,300**	**27,100**

Source: Natural Power

4.3. Re-Use Volumes of Excavated Peat

In order to estimate the volume of peat that can be re-used; Natural Power has applied experience from the construction management of wind farms across an array of upland peat sites. Table 4.6 below provides the estimated total re-use volume. The following additional design assumptions salient to the re-use of excavated peat are highlighted below:

- The uppermost 0.5 m of excavated peat at all infrastructure locations will be accommodated in the finishing and landscaping of each infrastructure element;
- The finishing and landscaping of the access tracks will be extended to a region of 3.5 m either side of the running length;
- Re-instated peat will not be isolated above the water table. Peat re-instatement will be sustainable and allow for vegetation regeneration or otherwise where a perched groundwater regime can develop. If suitable to the ecological conditions on site it may be appropriate to promote the establishment of dry heath conditions where peat cannot be replaced below groundwater level.
- The formulation of a detailed construction method statement shall incorporate detailed construction design and sequencing for the reinstatement purposes that will allow refinement of the excavation volumes presented in this document. These plans shall draw on detailed site investigation information gathered prior to the commencement of construction; and
- Appropriate signage shall also be considered to warn of potentially soft ground hazards. The safety measures shall be maintained for as long as the hazard remains, which may be several years following construction. Typically, vegetation re-growth and natural stabilisation of the wetland areas would be anticipated within approximately two years following reinstatement. Ongoing periodic monitoring of the progress of restoration would be required to ensure fencing is maintained until the wetland is fully established.
- During the excavation and re-use of peat deposits the two layered structure of the 'acrotelm' and underlying 'catotelm' shall be preserved as far as is practicable (Figure 4.2). This approach will aid in the successful re-vegetation and prevent drying and desiccation of the peat. Where the catotelmic peat becomes separated appropriate measures shall be in place to ensure this material is stabilised prior to re-use. This will be verified by a suitably qualified geotechnical engineer.

Source: Good Practice During Wind Farm Construction

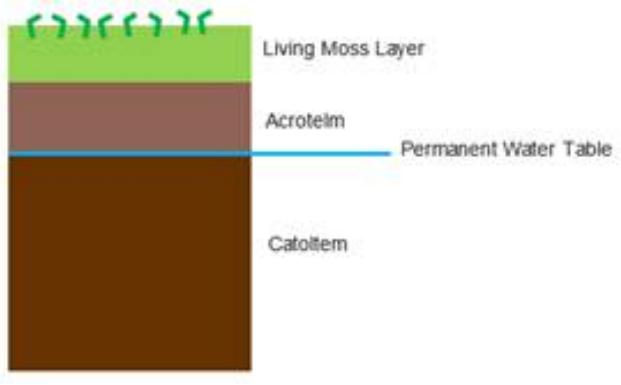

Figure 4.2: Diagram showing idealised peat structure

It should be noted that this assessment has not accounted for excavation volumes of glacial sub-soils or weak bedrock material which may be deemed unsuitable for incorporation into foundations and hardstand elements.

Re-use Volume Estimate

Table 4.6: Estimate of Peat Re-use Volumes

Construction Element	Peat Extraction Volume (m^3)	Peat Re-use Volume (m^3)	Surplus (+) or Capacity (-) (m^3)
Turbines	200	400	-200
Crane Pads	1,400	1,000	+400
Access Tracks	25,300	17,700	+7,600
Ancillary Infrastructure	0	0	0
Total	26,900	19,100	**+7,800**

Source: Natural Power

Table 4.6 shows the excavated volumes of peat and potential re-use volume at each infrastructure element without further control measures. It shows that access tracks have produced the surplus peat volumes to be stored.

Further measures that should be adopted to minimise bulking of the excavated peat deposit include:

- Reduction of peat handling with re-use of peat undertaken as close as possible to the excavation site;
- Maintaining the integrity of the excavated peat mass including preservation of the surface acrotelm layer as far as is practicable; and
- Prevent the drying and desiccation of excavated peat deposits through timely re-vegetation and preservation of the surface hydrology systems.

There is an estimated 7,100m^3 surplus of material that requires additional consideration for controls on the minimisation of excavated peat volumes and ensuring suitable and sustainable re-use. This is discussed further within Section 4.4 below.

4.4. Reducing surplus of Peat Material

The Table below outlines steps that need to be taken to balance the peat volumes within the construction of the wind farm development.

Table 4.7: Additional peat re-use options

Action	Reduction in extracted peat	Additional re-use capacity	Loss of re-use capacity	Remaining Surplus (m3)
Use floating tracks for approximately half of the SE Access track. Areas of track indicated as 1m – 2m (yellow) on the peat depth map. Exact sections to be identified in detailed design.	**7,800**	**0**	**0**	**0**
			Total Peat Excavation with Control Measures - **19,100m^3**	
			Total Reuse Volume – **19,100m^3**	

Source: Natural Power

Utilising the above measures will result in all excavated peat being used for targeted and sustainable re-use across the development. This will require additional detailed design and construction activities which are outside of the scope of this report. It is envisaged the pre-construction environmental management plan (CEMP) would capture the detailed design of each infrastructure element incorporating the central findings of the peat management plan.

4.5. Temporary Peat Storage

Consideration for the storage of peat has been undertaken with input gathered from the Scottish Renewables Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste.

The temporary storage of excavated peat shall seek to minimise disturbance of deposits by minimising haul distance between temporary peat storage sites and re-use areas. In general, it shall be a priority to avoid a single site dedicated temporary peat storage area. A progressive construction method which re-cycles peat through excavation and timely re-instatement in a continuous process shall be adopted for the construction of access tracks, hardstand areas and foundation elements. However temporary infrastructure elements shall require storage of peat prior to re-instatement at the end of the construction phase.

Possible temporary storage areas have been identified and are shown on the peat depth map interpolation (Figure A.1) and in Figure 4.3 below.

Source: Natural Power, ESRI World Topo

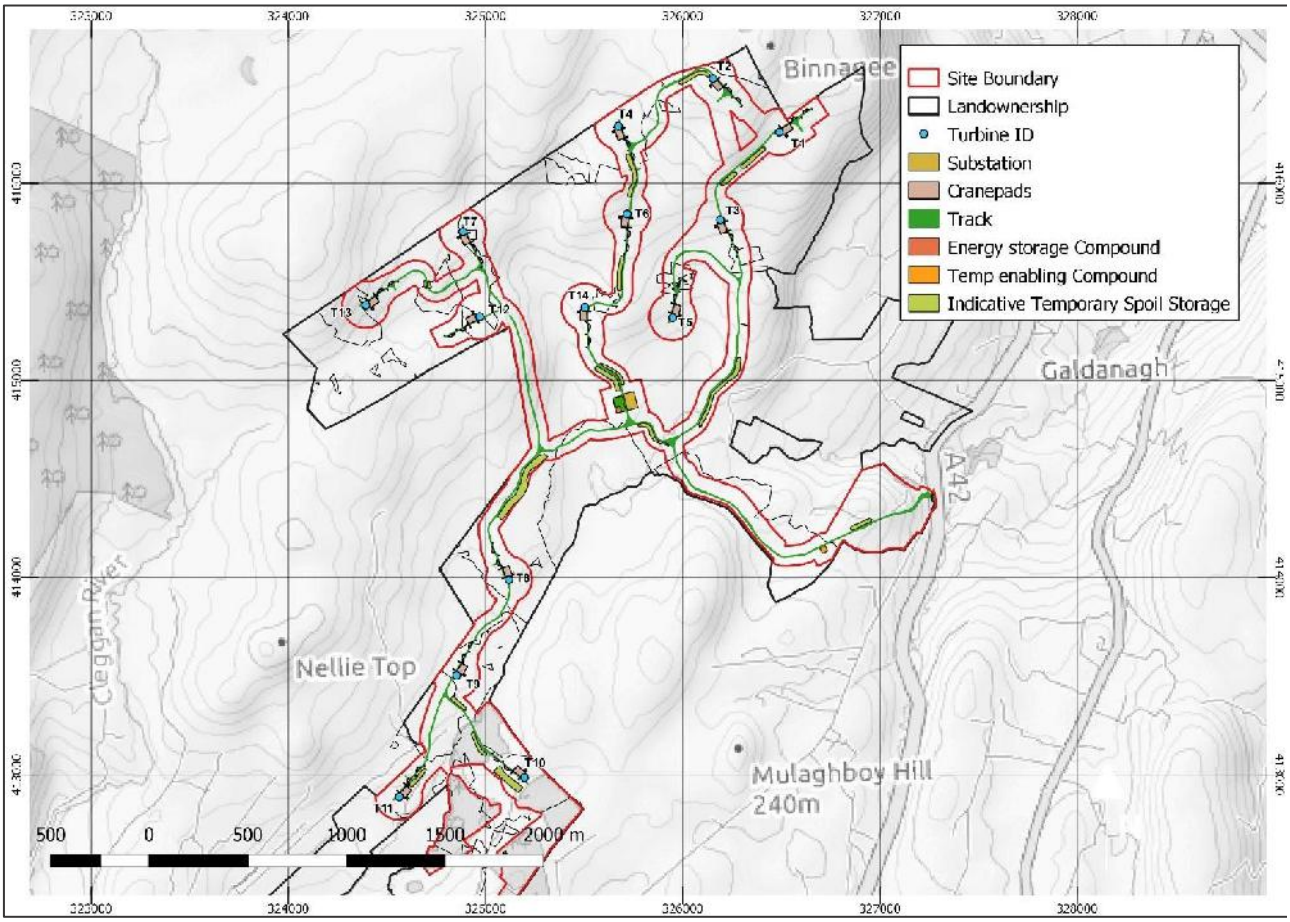

Figure 4.3: Temporary Peat Storage Locations

The exact areas identified for temporary storage shall only be confirmed following a detailed site investigation.

Surrounding these areas, the peat stability, drainage and pollution prevention mitigations shall be appraised as part of the detailed construction method statement. In general areas of deeper peat (>0.5 m) shall be avoided for dedicated temporary storage areas. It would be a priority to ensure that a future detailed site investigation provides information on the suitability of these temporary peat storage areas including the topographic profile, groundwater regime, and geotechnical properties of deposits underlying the temporary storage sites. Furthermore, it may be necessary to undertake further peat stability calculations based on finalised placement of temporary peat storage areas.

In temporary storage areas; peat shall be stored on geo-textile matting which acts as a protective barrier to the underlying soils and vegetation. The geo-textile shall be designed to prevent ingress of groundwater and erosion and de-stabilisation of the base of the stored peat. Peat shall be stored to a maximum depth of 1m with the peat turfs stored separately from underlying peat. The peat turfs or vegetation layer shall be stored in a single layer.

A system of watering the stored peat and turfs / vegetation shall be in place to ensure that the peat remains damp and prevents drying out and desiccation. The vegetation layer and seed bank shall therefore be sustained. This is an important element in the restoration of infrastructure, providing continuity with surrounding local vegetation upon reinstatement. For the duration of the temporary storage it shall be necessary to periodically monitor the condition of the stored peat and ensure the stability is maintained. This may need to be undertaken by a suitably qualified geotechnical engineer.

4.6. Limitations of Assessment

The peat extraction and re-use volumes are intended as a preliminary indication. The total peat volumes are based on a series of assumptions for the development layout and peat depth data averaged across discrete areas of the development. Such parameters can still vary over a small scale and therefore local topographic changes in the bedrock profile may impact the total accuracy of the volume calculation. Where total volumes have been stated these have been rounded to the nearest 100 m^3 in order not to convey a false accuracy.

The accuracy of these predictions may be improved though detailed site investigation (pre-construction). It is therefore important that the Peat Management Plan remains a live document throughout pre-construction and construction phases and is encapsulated within the wider Environmental Management Plan. The peat management plan and volumetric assessments can be updated as more accurate information becomes available.

Interpolated peat depth map (Appendix A.1) illustrates the peat depth across the site, thus giving an indicative assessment of the peat depths at various infrastructure locations. As will be discussed in the following sections, the excavated peat and peaty soils across the site can be used in a variety of scenarios including dressing side slopes on the roads; backfill over turbine bases and used in landscaping of access tracks.

5. Reinstatement Methodologies

Prior to commencing the construction excavation works, consideration will be given to methods for handling and holding the excavated materials, particularly peat. Haulage distances for the excavated material will be minimised, in order to reduce the potential impact on the peat structure. Peat has the potential to lose structural integrity upon excavation particularly when double handled or moved around the site. Peat handling can also increase the bulking factor of the material which has the overall effect of increasing the volume of peat which will need to be re-used across the site. Here are presented reinstatement measures that can be adopted for the main infrastructure components associated with the development.

5.1. Access Tracks

During track excavation works, where possible the vegetated top layer of material, which holds the seedbank, will be stripped and set to the side of the worked area for re-use in the re-profiling and track verge reinstatement works. The vegetative layer will be stripped as whole turves, where tree stumps are not present, and will be set aside vegetation side up. Figure 5.1 indicates where good practice has promoted vegetation re-establishment.

Source: SNH, FLS

Figure 5.1: Effective Turf Management and subsequent re-establishment of verge

Where cut and fill tracks are required in areas of peat or remnant peat habitat, then reinstatement will involve laying subsoil peat on the cut batters and then placing peat turves and clods on top of this. Reinstatement will be completed as soon as possible following construction to minimise the risk of turf drying. Restoration will be carried out as track construction progresses (Figure 5.2).

Source: Natural Power

Figure 5.2: Example of verge reinstatement ongoing with drainage provision

In order to obtain the best results, the previously stripped soils, vegetated layers or turves will be brought back over the verges of constructed tracks within as short a time period as reasonably practicable, to give the seed bank and vegetation the best chance of an early regeneration. Where reasonably practicable, turves and topsoil will be matched to the adjacent habitat.

Where practical, if storage is required, the layers will be correctly stored in their respective soil/peat horizons, i.e. in the layers that they were stripped in, so when reinstated they can be put back in the correct order. This also provides the seedbank and vegetation the best chance of early regeneration. If temporary storage of excavated materials is required, then material will be stored safely, and the method of storage will be reasonably minimised in order to reduce areas of additional disturbance. If materials are to be stored for any length of time, then these designated areas will be agreed with the Environmental Clerk of Works (ECoW) prior to the storage of any material. Consideration will also be given to periodically wetting the vegetation layers in order to prevent drying out. If this method is implemented, any runoff will be dealt with appropriately and will not be allowed to discharge into any adjacent watercourses unless treated.

Peat will only be used to re-profile or finish off the edges of the track or where construction has damaged the surface layer (Figure 5.3). In order to re-establish vegetation in these areas as quickly as possible peat turves will be utilised wherever practical.

Source: Natural power

Figure 5.3: Example of access track verge reinstatement

The soil and peat material that is utilised for the track edge reinstatement will not be spread too thinly. If the material is spread too thinly then there is a tendency for it to dry out and crack, particularly during prolonged dry periods. This subsequently means that the soil/peat material will be unstable because the root system has not had an opportunity to establish. This is very much dependent upon the time of year that the work is taking place and also the altitude. These factors affect the growing performance of the vegetated turf. Early reinstatement will be undertaken as this provides for the most beneficial results.

Care will also be taken to ensure that excessive material is not used during the re-profiling and reinstatement of the track verges. In addition, excess peat will also not be used for reinstatement of track edges where it can lead to the additional loss of habitat, by smothering the existing adjacent vegetation and preventing re-growth of the vegetation next to the tracks. The addition of excessive materials may cause instability at the track edges and increase the risk of the creation of sediment laden runoff.

The fundamental aspects of track reinstatement are summarised as follows:

- Consider haulage methods and specified storage locations in relation to areas being worked. Haulage distances to storage locations will be minimal;
- Vegetated turves and topsoil will be stripped with care and stored correctly i.e., separated in horizons and vegetation stored vegetation side up;
- For track reinstatement peat will be placed back in the correct horizon order and topsoil containing the seed bank will be on the top. If vegetated turves have been previously stripped, then these will be placed on top to maximise vegetation growth potential;
- Reinstatement of verges will be completed as soon as practical to minimise turf drying i.e. reinstatement can take place whilst track construction continues;

- Peat soil will not be spread too thinly during verge reinstatement in order to prevent cracking/drying out and excessive amounts of peat will also not be used as this can lead to unstable surfaces, effect drainage, loss of habitat via smothering of adjacent vegetation and create sediment laden runoff; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration, however, if required, following consultation with Northern Ireland Environment Agency (NIEA), re-seeding using a native species mix may be considered.

5.2. Cable Trenches

The reinstatement and storage of any excavated materials for the cable trenches will involve replacement of previously stripped soils, vegetated layers or turves (Figure 5.4). Timing of trench reinstatement works will also consider adjacent construction activities which may disturb any reinstatement works already carried out.

Source: Natural Power

Figure 5.4: Reinstatement of cable trench adjacent to access track

The amount of time between the excavation of the trench and subsequent reinstatement following cable laying will be minimised as much as practically possible. The reason for this is that the longer the stripped turves are stored for, the more they will degrade and become unsuitable for successful reinstatement. Reinstatement will take place as soon as possible, trenches which are left open for a long period of time will have a tendency, to act as conduits for surface water runoff, thus potentially leading to increased sediment loading due to erosion. This could potentially affect the sites watercourses and lead to the occurrence of a pollution event.

The type of vegetation used for reinstatement will not differ significantly from the adjacent area. The fundamental aspects of cable trench reinstatement are summarised as follows:

Cable trenches will be constructed to the relevant detailed design specifications;

- Cable trenches will be constructed adjacent to access tracks, i.e. reducing construction impacts on virgin ground;

- As a general principal, reinstated areas will be not be re-disturbed. This will be avoided where practical though not always possible due to construction sequencing;
- Stripping, storage and reinstatement of excavated materials will be as per best practice;
- Time between trench excavations and reinstatement will be planned to reduce the potential for stored turf layers to dry out and decompose; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration.

5.3. Wind Turbine Foundations

Only one Wind Turbine Foundation (T13) is considered to be within significant peat deposits. Where practical the peat turves and topsoil will be stored around the perimeter of the foundation excavation, as shown in Figure 5.5. A plan showing where the material is to be stored will also be created prior to the works commencing. In areas where storage of the peat turves or excavated material adjacent to the works is not possible, then the material will be taken to the nearest agreed storage areas as soon as possible.

Source: Natural Power

Figure 5.5: Excavated material stockpiled around the perimeter of the foundation excavation

The turbine foundations will be backfilled with the excavated material. Not all excavated material will be suitable for backfilling or reinstatement. The previously stripped and stored soils, and vegetated layers or turves will then be spread over the disturbed area, caused by turbine foundation construction (Figure 5.6). Where turbine bases are constructed in peat, reinstatement will involve laying subsoil peat on the backfilled area and then placing the vegetated peat turves on top. Reinstatement will be carried out as soon as practically possible following completion of foundation construction to minimise the risk of turves/vegetated layers drying out.

Source: Natural Power

Figure 5.6: Minimising peat excavation through displacement construction methods.

The fundamental aspects of turbine foundation reinstatement are summarised as follows:

- Construction works will be carried out to the detailed specification of the turbine foundation design and to permit adequate temporary works. Excessive peat excavation will be minimised.
- Stripping, storage and reinstatement of excavated materials will be as per best practice;
- A detailed plan of where excavated material will be stored will be created;
- Subsoil/peat will be spread over the backfilled area during reinstatement. Peat turves will then be placed on top to encourage natural re-growth of the vegetation;
- Time between turbine foundation excavation and reinstatement will be planned to reduce the potential for stored turf layers to dry out and decompose; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration.

5.4. Crane Hardstanding

Reinstatement of the crane pads will not occur:

- In the past crane pads have been reinstated using a layer of peat following construction. On many sites this layer has been stripped back within 2-3 years of operation to allow maintenance works to take place; and
- When the peat is stripped back, it mixes with the stone from the hardstanding, thus contaminating the peat layer and making it unsuitable for re-use for reinstatement.
- Due to the requirement for hardstands to remain in place, and use of crane pad areas during maintenance activities, levels of vegetation re-growth are liable to be low if crane hardstands are covered.
- The area around the crane pad and any exposed batters will be reinstated with previously stripped soils, vegetated layers and turves, using the same methods to those described for track reinstatement.

5.5. Ancillary Infrastructure

All temporary constructed areas will be removed and reinstated following construction. Following removal of temporary site accommodation, storage, equipment and materials, all areas will then be reinstated. The hardstand surface will be lifted or scarified or loosened prior to re-soiling to aid with drainage and re-generation.

The reinstatement will involve reprofiling/landscaping to ensure that the reinstated area blends in with the surrounding area. Suitable materials i.e. topsoil and/or peat will then be placed over the area in appropriate horizons i.e. in the correct order. The material used for the reinstatement works (often that which was excavated for the temporary construction area), will be stored and managed adjacent to the temporary construction areas but away from watercourses and other sensitive receptors.

It is highly probable that the temporary construction areas, such as the site compound will only be required for the duration of the construction period. Therefore, it is possible that any stripped turves may not be suitable reinstatement vegetation may therefore be allowed to regenerate naturally. Natural regeneration could take several years and is dependent upon the type of adjacent vegetation and the altitude of the location. Re-seeding will be considered if required. If re-seeding is required, the seed type and mix will be agreed in consultation with NIEA.

The fundamental aspects of temporary construction reinstatement are summarised as follows:

Areas will be re-profiled/landscaped to ensure they blend in with the surrounding area;

Topsoil/peat will then be spread over the area in its appropriate horizons;

Material used for the reinstatement will be stored appropriately where practical adjacent to the temporary construction area;

Stripped turves may dry out due to the length of time they are stored (compound required for duration of construction period) therefore may not be suitable for reinstatement; and

Natural regeneration of vegetation is the preferred option for reinstatement and restoration.

6. Monitoring

The success of construction and the subsequent re-use of peat across the site can be monitored to ensure that effects on the peat land environment are appropriately understood and subsequently reduced via any remedial works that can be undertaken. The details of any required monitoring would be discussed and agreed with the NIEA and the Local Planning Authority prior to commencement. Appropriate monitoring is important to:

Provide reassurance that established in-place mitigation and reinstatement measures are effective and that the site is not having a significant adverse impact upon the local and/or wider environment;

Indicate whether further investigation is required and, where pollution is identified or unsuccessful reinstatement, the need for additional mitigation measures to prevent, reduce or remove any impacts on the environment; and

Understand the long-term effects of the site on the natural environment.

Due to the nature of the construction activities and the possibility that such works can increase the volume of dissolved and particulate matter from entering the natural drainage network a robust hydrological monitoring strategy will be implemented.

A reinstatement monitoring strategy can also be implemented, where surveys can be carried out to monitor the success of peat re-use and subsequent reinstatement. Complimentary to the hydrological monitoring highlighted above and best practise geotechnical monitoring, the success of vegetation reinstatement can provide an insight into the effects of the wind farm on the local environment. Full details of the environmental monitoring strategies will be finalised following consultation with DOE, NIEA and the Local Planning Authority.

7. References

- BS EN 1997-1:2004, EC7: Geotechnical Design, Part 1: General Rules.
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- Good Practice During Wind Farm Construction, A joint publication by: Scottish Renewables, Scottish Natural Heritage, Scottish Environmental Protection Agency, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science, AEECoW, 4th Edition, 2019.
- Developments on Peatland: Guidance on the assessment of peat volumes, re-use of excavated peat and the minimisation of waste (A joint publication by Scottish Renewables, Scottish Natural Heritage (SNH), SEPA, Forestry Commission Scotland, 2012).
- Floating Roads on Peat (Forestry Civil Engineering & SNH, 2010).
- Soils and environment of Northern Ireland, www.afbini.gov.uk.
- The Northern Ireland Department for Infrastructure Flood Maps, www.infrastructure.ni.gov.uk.

A. Maps

A.1 Peat Depth Interpolation and Temporary Peat Storage Areas

322000 324000 326000 328000

416000 414000 412000

Collin Top
482m

Binnagee

Galdanagh

Nellie Top

Ticloy Top

Cleggan River

Braid

A42

B97

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14

Peat Spoil Management

Dependent upon the detailed civil infrastructure design, several types of access and hardstand construction may be adopted for the development.

Excavated Access: Any peat or peaty soils to be excavated to a suitable bearing stratum prior to access track construction. Excavated turfs of peat/soil is to be cut and stored in temporary storage locations. This peat will then be used in the re-vegetation of side slopes along excavated roads.

Floating Access: This method of construction is considered unlikely on site with average peat depths for access tracks less than 1.0m. However this kind of construction does not create any peat soil and so may be a preferred method in localised areas of deeper peat. Following pre-construction and design, suitable re-enforced rock fill road would be constructed over in-situ soils without any excavation.

Upgraded Existing Access: Following detailed pre-construction investigation and design, the type of upgrade track will be determined. Where any excavation of peaty soils takes place, it is thought this would be accommodated in the same manner as excavated access.

Foundations: Peat is to be stored in designated areas. Indicative areas for this temporary peat storage have been identified on the plan. These areas are to be agreed on-site by the ecological clerk of works and the supervising geotechnical engineer. No peat is to be stored in areas with an elevated risk of spoil storage, this includes prohibition of spoil storage at T04, T12, T13 and T14.

Temporary Storage: Due to construction programming there is likely to be a requirement for temporary storage of peat and peaty soils before it is used for reinstatement. Works should be planned to reduce the amount of time peat is stored to a minimum. Excavation and haulage should seek to maintain the integrity of the peaty soil. A system of watering the stored peat and turfs shall be in place to prevent drying out and desiccation. For the duration of the temporary storage the condition and stability of the peat should be periodically monitored by a suitably qualified geotechnical engineer. Surface water run-off should be managed through cut-off ditches and silt catchers around storage locations.

Project:

Unshinagh Wind Farm, Co. Antrim, Northern Ireland

Title:

Map A1: Peat Interpolation and Temporary Peat Storage Area

Key

- Planning application boundary
- Landownership
- Proposed turbine
- Proposed crane pad
- Proposed track
- Proposed substation
- Proposed construction compound
- Proposed energy storage compound
- Proposed temporary enabling compound
- Indicative temporary soil storage
- Proposed forestry to be removed

Peat depth (m)*

- 0.5 - 1
- 1 - 2
- 2 - 3
- > 3

* Interpolation method: Kriging

© Thunderforest

Scale @ A3: 1:25,000

Coordinate System: TM65 Irish National Grid

N

0 0.25 0.5 0.75 1 km

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