

TECHNICAL APPENDIX 7 – ECOLOGY AND ORNITHOLOGY APPRAISAL

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TECHNICAL APPENDIX 7.1: ECOLOGY AND ORNITHOLOGY SURVEY RESULTS

1.1 Detailed Field Survey Results

1.1.1 Habitats

The following habitats and dominant species were recorded throughout the field survey area, as shown on Figures 7.3a-i.

Semi-natural Broadleaved Woodland A1.1.1

This habitat type occurs throughout the site, frequently associated with watercourses. The proposed route intersects this habitat type at six locations, as shown on Figures 7.3 a,b, c, d, and e, North of Glenassel, two locations south of Barbae Wood, to the south-east of Laggan Bridge, south-east of Maclachrieston and in Mahaffie Wood. Dominant species include sycamore *Acer pseudoplatanus*, ash *Fraxinus excelsior*, beech *Fagus sylvatica*, hazel *Corylus avellana* and willow *Salix sp.* With alder *Alnus glutinosa*, aspen *Populus tremula*, eared willow *Salix aurita* and common nettle *Urtica dioica* all abundant.

Plantation Broadleaved Woodland A1.1.2

This habitat was recorded as areas of planted young trees (<10 years old) at the northern end of the route, west of Tralodden Bridge and east of Barbrae Farm. Here the dominant species include ash, hawthorn *Crataegus monogyna* and rowan *Sorbus aucuparia*. Sessile oak *Quercus petraea* aspen and alder are frequent.

This habitat was also recorded as a line of broadleaved trees that border a track north-east of Bellamore. Beech was the dominant species here with hawthorn also frequent.

Plantation Coniferous Woodland A1.2.2

This habitat type occurs largely within Barbrae Wood where the proposed route intersects the habitat, as shown on Figures 7.3c. A large stand of plantation is present east of the proposed OHL north of Kilbride Knowe, the route does not intersect this stand, as shown on Figures 7.3g and h. The dominant species is Sitka spruce *Picea sitchensis* with occasional larch *Larix decidua*.

Mixed Woodland Plantation Woodland A1.3.2

A small area of this habitat type is present at the northern end of the proposed OHL route. The proposed route intersects this habitat just east of Tralodden Hill, as shown on Figure 7.3a. Sycamore, sessile oak, ash and larch were all present in a stand of trees estimated to be less than 25 years old.

Scrub - Dense/Continuous A2.1

Patches of this habitat are spread throughout the site. A small area is present close to the proposed OHL south of Tralodden Bridge. There are various patches within a mosaic of habitats north of the proposed section of underground cable, as shown on Figure 7.3h. The dominant species is gorse *Ulex europeus*.

Scrub - Scattered A2.2

A small patch of this habitat type is present surrounding a pond north of Garleffin Hill. Eared willow and brambles *Rubus fruticosus* were both abundant with silver birch *Betula pendula* frequent. Soft rush *Juncus effusus* and yellow iris *Iris pseudacorus* were dominant and frequent respectively.

Broadleaved Parkland/Scattered Trees A3.1

Two lines of mature beech trees intersect the proposed OHL route east of Laggan Bridge, as shown on Figure 7.3d.

Each tree line contains trees with bat roost potential (Target Notes 4 and 5).

Semi-improved Neutral Grassland B2.2

This is the most common habitat found along the route of the proposed development as shown on Figures 7.3c-i. This habitat is dominated by grasses including; perennial rye grass *Lolium perenne*, Yorkshire fog *Holcus lanatus*, crested dogstail *Cynosurus cristatus*, tufted-hair grass *Deschampsia cespitosa*, wavy-hair grass *Deschampsia flexuosa* and annual meadow grass *Poa annua*. Abundant species include creeping buttercup *Ranunculus repens*, creeping soft grass *Holcus mollis* and white clover *Trifolium repens*. Soft rush is frequent and spear thistle *Cirsium vulgare* and red fescue *Festuca rubra* are occasional. Common hogweed *Heracleum sphondylium* is rare.

Improved Grassland B4

This habitat is dominant around the northern section of the proposed development, from High Tralorg to Tormitchell Quarry, as shown on Figures 7.3a-b. There are also patches of this habitat present further south along the proposed route, as shown on Figures 7.3d-f. This habitat is heavily grazed by sheep and cows in most areas. The dominant species are perennial rye grass, crested dogstail, creeping soft grass and Yorkshire fog. White clover and creeping buttercup are frequent, with occasional broad-leaved dock *Rumex obtusifolius* and soft rush.

Marshy Grassland B5

Patches of this habitat are located between High Tralorg and Tormitchell Quarry, as shown on Figure 7.3a. Larger areas of this habitat type are also present along the proposed route between Balligmorrie Bridge and Mark Hill Substation, as shown on Figures 7.3f-i.

This habitat is dominated by soft rush, sharp-flowered rush *Juncus acutiflorus* and purple moor grass *Molinia caerulea*. Abundant species include common horsetail *Equisetum arvense*, meadowsweet *Filipendula ulmaria*, creeping soft grass and wavy-hair grass. Occasional species include yellow iris and marsh marigold *Caltha palustris*.

All of the areas identified as potentially being Groundwater Dependent Terrestrial Ecosystems (GWDTE) belonged to this habitat. These are discussed further in Section 1.1.2 below and in Chapter 8: Hydrology of the Environmental Assessment.

Bracken – Continuous C1.1

Several patches of continuous bracken *Pteridium aquilinum* habitat occur throughout the site. There is a patch south of the Water of Assel, as shown on Figure 7.3c, and many patches at the southern extent of the site, as shown on Figures 7.3g-h.

Blanket Sphagnum Bog E1.6.1

There is a large expanse of blanket bog north of Knocknabone, as shown on Figures 7.3g-h.

This habitat is dominated by sphagnum species (*Sphagnum capillifolium* and *S. papillosum*) with purple moor grass, cross-leaved heather *Erica tetralix* and deer grass *Trichophorum cespitosum*. Abundant species include bog asphodel *Narthecium ossifragum*, hare's-tail cotton grass *Eriophorum vaginatum* and common marsh-bedstraw *Galium palustre*.

Wet Modified Bog E1.7

This habitat is located near areas of marshy grassland towards the southern extent of the proposed development, as shown on Figures 7.3f and 7.3i. The habitat is dominated by purple

moor grass, wavy-hair grass, cross-leaved heather and common tormentil *Potentilla erecta*. Frequent species include hare's-tail cotton grass, soft rush, blueberry *Vaccinium myrtillus*, heath bedstraw *Galium saxatile* and common heather *Calluna vulgaris*. Occasional wetter areas contained flat-topped bogmoss *Sphagnum fallax*, red bogmass *S. capillifolium* and blunt-leaved bogmoss *Sphagnum palustre*.

Intact Hedge – Species-poor J2.1.2

A line of intact hawthorn hedge with an understorey of butterbur *Petasites hybridus* surrounds semi-improved grassland intersecting the proposed OHL route immediately south of Mahaffie Wood, east of Pinmore.

Defunct Hedge - Species-poor J2.2.2

A line of defunct hawthorn hedge was recorded in close proximity to the proposed route at High Tralorg, as shown on Figure 7.3a. A line of discontinuous hawthorn is present south-east of Pinmore, intersecting a wetter area of semi-improved grassland, as shown on Figure 7.3e.

Hedge with Trees – Species-poor J2.3.2

A hedge containing broadleaved trees intersects the proposed OHL route south-west of Balligmorrie, running south of the B734 throughout an area of improved grassland, as shown on Figure 7.3f.

1.1.2 Groundwater Dependant Terrestrial Ecosystems (GWDTE)

Areas of potential GWDTE habitat have been identified in proximity to the proposed development; these are considered in further detail in Appendix 8.2: Groundwater Dependent Terrestrial Ecosystem (GWDTE) Appraisal.

1.1.3 Protected Species

Sand Martins

A colony of approximately 10 sand martin *Riparia riparia* burrows was recorded in the western bank of a tributary of the Water of Assel.

Trees with Bat Roost Potential

Trees with Bat Roost Potential (BRP) were recorded at Target Notes 4, 5, 7, 8, 11, 18 and 20.

Water Voles

Suitable habitat for water voles *Arvicola amphibius* was recorded at Target Notes 9, 12, 13, 15, 17, 21, 23 and 24. Runs were recorded at these locations (tunnels in the grass used as water voles move through the undergrowth) although no burrows or droppings were recorded.

Otters

An otter *Lutra lutra* spraint was recorded on the bank of the River Stinchar (Target Note 10). This suggests that otters use the river, but no holts were recorded within the site.

Great Crested Newts

Four ponds in the site were assessed for their ability to support great crested newts *Triturus cristatus*. These ponds are shown as Target Notes 16, 22, 25 and 26 on Figures 7.3g and h. These ponds were assessed using the Habitat Suitability Index¹ (HSI), which resulted in scores of 0.66, 0.62, 0.66 and 0.56, respectively. These results fall into the average classification of suitability, therefore, great crested newts could not be assumed to be absent within the site.

¹ Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal 10 (4), 143-155.

However, the four ponds were sampled for great crested newt eDNA and were found to be negative, as shown by Technical Appendix 7.4.

Target Notes

Target Notes recorded during the Phase 1 habitat survey are detailed in Table 7.1.2.

Table 7.1.2: Ecological Target Notes		
Target Note Number	Grid Reference	Comment
1	NX 22823 96820	Dry stone wall.
2	NX 22791 96653	Discontinuous hawthorn hedge.
3	NX 22057 93584	Sand martin nesting- approximately 10 burrows in western bank of small tributary of the Water of Assel.
4	NX 21533 93293	Line of beech and hawthorn. Mature trees have bat roost potential.
5	NX 21246 93149	Line of beech trees with bat roost potential.
6	NX 21166 92681	Recently planted hedgerow of hawthorn and bird cherry <i>Prunus padus</i> .
7	NX 21300 91602	Avenues of beech, with some ash and alder. Trees have bat roost potential.
8	NX 21318 91550	Avenues of beech, with some ash and alder. Trees have bat roost potential.
9	NX 21354 91420	Potential water vole habitat, evidence of runs but no droppings found.
10	NX 21556 90834	Otter spraint on River Stinchar.
11	NX 21523 90830	Trees with bat roost potential in Mahaffie Wood.
12	NX 22229 89669	Potential water vole habitat, evidence of runs but no droppings found.
13	NX 23029 88815	Potential water vole habitat, evidence of runs but no droppings found.
14	NX 23660 88616	Docherneil Burn crossing: see Photos 1-3 in Appendix 7.3.
15	NX 23314 88216	Potential water vole habitat, evidence of runs but no droppings found.
16	NX 23806 88168	Pond with potential great crested newt (HSI = 0.66) as shown in Photo 7 in Appendix 7.3.
17	NX 23430 87980	Potential water vole habitat, evidence of runs but no droppings found.
18	NX 23746 87324	Line of beech trees along road boundary with bat roost potential.
19	NX 23974 87328	Muck Water crossing see Photos 4-6 in Appendix 7.3.
20	NX 23804 87200	Trees with bat roost potential, primarily ash in woodland containing hazel, silver birch, elder <i>Sambucus nigra</i> , hawthorn and willow <i>Salix sp.</i>
21	NX 23772 87158	Potential water vole habitat, evidence of runs but no droppings found.

22	NX 23928 87133	Pond with potential great crested newt (HSI = 0.62) as shown in Photo 8 in Appendix 7.3.
23	NX 23838 86735	Potential water vole habitat, evidence of runs but no droppings found.
24	NX 23842 86469	Potential water vole habitat, evidence of runs but no droppings found.
25	NX 24238 87624	Pond with potential great crested newt (HSI = 0.66).
26	NX 24396 87384	Pond with potential great crested newt (HSI = 0.56).
27	NX 23472 87384	Wetter/pooled area in marshy grassland, as shown by Photo 9 in Appendix 7.3. Some <i>Sphagnum sp.</i> , jointed rush <i>Juncus articulatus</i> , soft rush and marsh thistle <i>Cirsium palustre</i> .

1.1.4 Breeding Raptors

The results of the breeding raptor survey are confidential and provided in Appendix 7.5: Confidential Ornithology Survey Results.

Weather Details

Table 7.1.4 provides details of weather conditions during vantage point surveys for breeding raptors.

Table 7.1.4: Weather Conditions								
VP ID	Date and Time	Wind Speed	Wind Direction	Precipitation	Temp (°C)	Cloud Cover (%)	Cloud Base (m)	Visibility (km)
Barbae	2016-05-03 9:30	3	NE	3r	3	50	500	2
Barbae	2016-05-03 10:30	3	NW	3r	4	40	500	2
Barbae	2016-05-03 11:30	3	NW	3r	3	60	500	2
Knockodhar Wood	2016-05-03 9:00	2	NE	3r	3	40	500	2
Knockodhar Wood	2016-05-03 10:00	3	NW	3r	4	30	500	2
Knockodhar Wood	2016-05-03 11:00	2	NW	3r	3	60	500	2
Barbae	2016-06-13	3	SW	0	12	70	500	2
Barbae	2016-06-13	3	SW	0	12	100	500	2
Barbae	2016-06-13	3	SW	0	12	100	500	2
Knockodhar Wood	2016-06-13	3	SW	0	12	70	500	2
Knockodhar Wood	2016-06-13	3	SW	0	12	100	500	2
Knockodhar Wood	2016-06-13	3	SW	0	12	100	500	2
Barbae	2017-03-31 8:15	3	SW	5r	11	100	300	1.5
Barbae	2017-03-31 9:15	4	SW	5r	11	100	300	1.5

Table 7.1.4: Weather Conditions

Glenassel	2017-03-30 18:25	4	SW	1r	10	100	200	1
Glenassel	2017-04-11 8:30	2	NW	0	8	90	500	2
Glenassel	2017-04-11 9:30	3	NW	2r	8	90	500	2
Glenassel	2017-04-11 10:30	4	NW	0	10	90	500	2
Barbae	2017-04-11 8:30	3	SW	0	7	80	300	2
Barbae	2017-04-11 9:30	4	SW	0	8	70	400	2
Barbae	2017-04-11 10:30	3	SW	0	8	80	400	2
Tormitchell	2017-04-11 8:30	1	SE	0	7	100	500	2
Tormitchell	2017-04-11 9:30	2	SE	1r	8	80	500	2
Tormitchell	2017-04-11 10:30	1	SE	1r	9	80	500	2
Barbae	2017-05-10 8:00	0		0	8	30	500	2
Barbae	2017-05-10 9:00	1	SW	0	12	30	500	2
Barbae	2017-05-10 10:00	1	SW	0	12	60	500	2

Table 7.1.4: Weather Conditions								
Glenassel	2017-05-10 8:00	0		0	10	10	500	2
Glenassel	2017-05-10 9:00	1	E	0	12	10	500	2
Glenassel	2017-05-10 10:00	1	E	0	14	10	500	2
Tormitchell	2017-05-10 8:00	0		0	7	10	500	2
Tormitchell	2017-05-10 9:00	1	SW	0	12	20	500	2
Tormitchell	2017-05-10 10:00	1	SW	0	13	50	500	2
Glenassel	2017-06-14 8:10	4	NW	1r	9	100	500	2
Glenassel	2017-06-14 9:10	4	NW	0	10	100	500	2
Glenassel	2017-06-14 10:10	3	NW	0	10	100	500	2
Barbae	2017-06-14 8:15	3	SW	2r	14	100	300	2
Barbae	2017-06-14 9:15	4	SW	0	14	100	500	2
Barbae	2017-06-14 10:15	5	SW	0	15	80	500	2
Tormitchell	2017-06-14 8:10	2	SE	3r	12	100	400	1.5

Table 7.1.4: Weather Conditions								
Tormitchell	2017-06-14 9:10	3	SE	0	13	100	400	2
Tormitchell	2017-06-14 10:10	3	SE	0	14	100	500	2

TECHNICAL APPENDIX 7.2: PROTECTED SPECIES LIST

Protected species known to occur naturally in Scotland & their protection

Taxon	Current taxon name	Common name	Legislation giving protection	Schedule or Annex listing
Reptile	<i>Vipera berus</i>	Adder	WCA 1981	Schedule 5 ^{1,4}
Fish	<i>Alosa alosa</i>	Allis shad	HR 1994	Schedule 3
Fish	<i>Alosa alosa</i>	Allis shad	WCA 1981	Schedule 5 ^{1,2,3a}
Vascular Plant	<i>Lychnis alpina</i>	Alpine catchfly	WCA 1981	Schedule 8
Moss	<i>Mielichhoferia mielichhoferi</i>	Alpine copper-moss	WCA 1981	Schedule 8
Vascular Plant	<i>Erigeron borealis</i>	Alpine fleabane	WCA 1981	Schedule 8
Vascular Plant	<i>Gentiana nivalis</i>	Alpine gentian	WCA 1981	Schedule 8
Lichen	<i>Pertusaria bryontha</i>	Alpine moss-pertusaria	WCA 1981	Schedule 8
Vascular Plant	<i>Arabis alpina</i>	Alpine rock-cress	WCA 1981	Schedule 8
Vascular Plant	<i>Cicerbita alpina</i>	Alpine sow-thistle	WCA 1981	Schedule 8
Lichen	<i>Alectoria ochroleuca</i>	Alpine sulphur-tresses	WCA 1981	Schedule 8
Vascular Plant	<i>Woodsia alpina</i>	Alpine woodsia	WCA 1981	Schedule 8
Lichen	<i>Nephroma arcticum</i>	Arctic kidney-lichen	WCA 1981	Schedule 8
Fish	<i>Salmo salar</i> (only in fresh water)	Atlantic salmon	HR 1994	Schedule 3
Crustacean	<i>Austropotamobius pallipes</i>	Atlantic stream (white-clawed) crayfish	WCA 1981	Schedule 5 ^{2,4}
Bird	<i>Recurvirostra avosetta</i>	Avocet	WCA 1981	Schedule 1 (Part I)
Mammal	<i>Meles meles</i>	Badger	PBA 1992	not applicable
Mammal	<i>Meles meles</i>	Badger	WCA 1981	Schedule 6
Moss	<i>Sphagnum balticum</i>	Baltic bog-moss	WCA 1981	Schedule 8
Fish	<i>Barbus barbus</i>	Barbel	HR 1994	Schedule 3
Bird	<i>Tyto alba</i>	Barn owl	WCA 1981	Schedule 1 (Part I)
Bird	<i>Tyto alba</i>	Barn owl	WCA 1981	Schedule 3 (Part I)
Fish	<i>Cetorhinus maximus</i>	Basking shark	WCA 1981	Schedule 5
Mammal	<i>Plecotus auritus</i>	Bat - Brown long-eared	HR 1994	Schedule 2: European protected species
Mammal	<i>Pipistrellus pipistrellus</i>	Bat - Common pipistrelle	HR 1994	Schedule 2: European protected species
Mammal	<i>Myotis daubentonii</i>	Bat - Daubenton's	HR 1994	Schedule 2: European protected species
Mammal	<i>Nyctalus leisleri</i>	Bat - Leisler's	HR 1994	Schedule 2: European protected species
Mammal	<i>Pipistrellus nathusii</i>	Bat - Nathusius' pipistrelle	HR 1994	Schedule 2: European protected species
Mammal	<i>Myotis nattereri</i>	Bat - Natterer's	HR 1994	Schedule 2: European protected species
Mammal	<i>Nyctalus noctula</i>	Bat - Noctule	HR 1994	Schedule 2: European protected species
Mammal	<i>Pipistrellus pygmaeus</i>	Bat - Soprano pipistrelle	HR 1994	Schedule 2: European protected species
Mammal	<i>Myotis mystacinus</i>	Bat - Whiskered	HR 1994	Schedule 2: European protected species
Mammal	<i>Vespertilionidae</i> spp	Bats - All typical species	HR 1994	Schedule 2: European protected species
Mammal	<i>Erignathus barbatus</i>	Bearded seal	HR 1994	Schedule 3
Bird	<i>Panurus biarmicus</i>	Bearded tit	WCA 1981	Schedule 1 (Part I)
Bird	<i>Cygnus columbianus</i>	Bewick's swan	WCA 1981	Schedule 1 (Part I)
Bird	<i>Botaurus stellaris</i>	Bittern	WCA 1981	Schedule 1 (Part I)
Bird	<i>Phoenicurus ochruros</i>	Black redstart	WCA 1981	Schedule 1 (Part I)
Bird	<i>Turdus merula</i>	Blackbird	WCA 1981	Schedule 3 (Part I)
Bird	<i>Podiceps nigricollis</i>	Black-necked grebe	WCA 1981	Schedule 1 (Part I)

Bird	<i>Limosa limosa</i>	Black-tailed godwit	WCA 1981	Schedule 1 (Part I)
Bird	<i>Gavia arctica</i>	Black-throated diver	WCA 1981	Schedule 1 (Part I)
Moss	<i>Saelania glaucescens</i>	Blue dew-moss	WCA 1981	Schedule 8
Vascular Plant	<i>Phyllodoce caerulea</i>	Blue heath	WCA 1981	Schedule 8
Vascular Plant	<i>Hyacinthoides non-scripta</i>	Bluebell	WCA 1981	Schedule 8 ⁴
Bird	<i>Luscinia svecica</i>	Bluethroat	WCA 1981	Schedule 1 (Part I)
Moss	<i>Orthotrichum obtusifolium</i>	Blunt-leaved bristle-moss	WCA 1981	Schedule 8
Moss	<i>Grimmia unicolor</i>	Blunt-leaved grimmia	WCA 1981	Schedule 8
Bird	<i>Fringilla montifringilla</i>	Brambling	WCA 1981	Schedule 1 (Part I)
Bird	<i>Fringilla montifringilla</i>	Brambling	WCA 1981	Schedule 3 (Part I)
Moss	<i>Cyclodictyon laetevirens</i>	Bright-green cave-moss	WCA 1981	Schedule 8
Bird	<i>Pyrrhula pyrrhula</i>	Bullfinch	WCA 1981	Schedule 3 (Part I)
Lichen	<i>Fuscopannaria ignobilis</i>	Caledonian pannaria	WCA 1981	Schedule 8
Bird	<i>Branta canadensis</i>	Canada goose	WCA 1981	Schedule 2
Bird	<i>Tetrao urogallus</i>	Capercaillie	WCA 1981	Schedule 1 (Part I)
Mammal	<i>Tursiops truncatus</i>	Cetacean - Bottlenose dolphin	HR 1994	Schedule 2: European protected species
Mammal	Cetacea	Cetacean - Dolphins, porpoises and whales - All species	HR 1994	Schedule 2: European protected species
Mammal	<i>Phocoena phocoena</i>	Cetacean - Harbour or Common porpoise	HR 1994	Schedule 2: European protected species
Bird	<i>Fringilla coelebs</i>	Chaffinch	WCA 1981	Schedule 3 (Part I)
Butterfly	<i>Carterocephalus palaemon</i>	Chequered skipper	WCA 1981	Schedule 5 ⁴
Bird	<i>Pyrrhocorax pyrrhocorax</i>	Chough	WCA 1981	Schedule 1 (Part I)
Lichen	<i>Lecanactis hemisphaerica</i>	Churchyard lecanactis	WCA 1981	Schedule 8
Lichen	<i>Heterodermia propagulifera</i>	Collaroid rosette-lichen	WCA 1981	Schedule 8
Amphibian	<i>Rana temporaria</i>	Common frog	WCA 1981	Schedule 5 ⁴
Bird	<i>Melanitta nigra</i>	Common scoter	WCA 1981	Schedule 1 (Part I)
Mammal	<i>Phoca vitulina</i>	Common seal	HR 1994	Schedule 3
Bird	<i>Gallinago gallinago</i>	Common snipe	WCA 1981	Schedule 2
Bird	<i>Gallinago gallinago</i>	Common snipe	WCA 1981	Schedule 3 (Part III)
Amphibian	<i>Bufo bufo</i>	Common toad	WCA 1981	Schedule 5 ⁴
Bird	<i>Fulica atra</i>	Coot	WCA 1981	Schedule 2
Bird	<i>Fulica atra</i>	Coot	WCA 1981	Schedule 3 (Part III)
Bird	<i>Crex crex</i>	Corncrake	WCA 1981	Schedule 1 (Part I)
Bird	<i>Parus cristatus</i>	Crested tit	WCA 1981	Schedule 1 (Part I)
Bird	<i>Loxia spp</i>	Crossbills (all species)	WCA 1981	Schedule 1 (Part I)
Bird	<i>Sylvia undata</i>	Dartford warbler	WCA 1981	Schedule 1 (Part I)
Vascular Plant	<i>Diapensia lapponica</i>	Diapensia	WCA 1981	Schedule 8
Vascular Plant	<i>Cystopteris dickieana</i>	Dickie's bladder fern	WCA 1981	Schedule 8
Bird	<i>Charadrius morinellus</i>	Dotterel	WCA 1981	Schedule 1 (Part I)
Vascular Plant	<i>Saxifraga cernua</i>	Drooping saxifrage	WCA 1981	Schedule 8
Butterfly	<i>Hamearis lucina</i>	Duke of Burgundy fritillary	WCA 1981	Schedule 5 ⁴
Vascular Plant	<i>Gentianella uliginosa</i>	Dune gentian	WCA 1981	Schedule 8
Bird	<i>Prunella modularis</i>	Dunnock	WCA 1981	Schedule 3 (Part I)
Vascular Plant	<i>Eleocharis parvula</i>	Dwarf spike-rush	WCA 1981	Schedule 8
Lichen	<i>Peltigera lepidophora</i>	Ear-lobed dog-lichen	WCA 1981	Schedule 8
Lichen	<i>Gyalecta ulmi</i>	Elm gyalecta	WCA 1981	Schedule 8
Mollusc	<i>Atrina fragilis</i>	Fan mussel	WCA 1981	Schedule 5 ^{1, 2, 4, 5}
Vascular Plant	<i>Melampyrum arvense</i>	Field cow-wheat	WCA 1981	Schedule 8
Bird	<i>Turdus pilaris</i>	Fieldfare	WCA 1981	Schedule 1 (Part I)
Bird	<i>Regulus ignicapillus</i>	Firecrest	WCA 1981	Schedule 1 (Part I)
Lichen	<i>Bryoria furcellata</i>	Forked hair-lichen	WCA 1981	Schedule 8
Stonewort	<i>Lamprothamnium papulosum</i>	Foxtail stonewort	WCA 1981	Schedule 8
Mollusc	<i>Margaritifera margaritifera</i>	Freshwater pearl mussel	WCA 1981	Schedule 5
Bird	<i>Anas strepera</i>	Gadwall	WCA 1981	Schedule 2

Bird	Anas querquedula	Garganey	WCA 1981	Schedule 1 (Part I)
Lichen	Catolechia wahlenbergii	Goblin lights	WCA 1981	Schedule 8
Bird	Aquila chrysaetos	Golden eagle	WCA 1981	Schedule 1 (Part I)
Bird	Aquila chrysaetos	Golden eagle	WCA 1981	Schedule 1A
Bird	Aquila chrysaetos	Golden eagle	WCA 1981	Schedule A1
Bird	Aquila chrysaetos	Golden eagle	WCA 1981	Schedule 4
Lichen	Teloschistes flavicans	Golden hair-lichen	WCA 1981	Schedule 8
Bird	Oriolus oriolus	Golden oriole	WCA 1981	Schedule 1 (Part I)
Bird	Pluvialis apricaria	Golden plover	WCA 1981	Schedule 2
Bird	Pluvialis apricaria	Golden plover	WCA 1981	Schedule 3 (Part III)
Bird	Bucephala clangula	Goldeneye	WCA 1981	Schedule 1 (Part II)
Bird	Bucephala clangula	Goldeneye	WCA 1981	Schedule 2
Bird	Carduelis carduelis	Goldfinch	WCA 1981	Schedule 3 (Part I)
Bird	Accipter gentilis	Goshawk	WCA 1981	Schedule 1 (Part I)
Bird	Accipter gentilis	Goshawk	WCA 1981	Schedule 4
Vascular Plant	Lythrum hyssopifolia	Grass-poly	WCA 1981	Schedule 8
Fish	Thymallus thymallus	Grayling	HR 1994	Schedule 3
Amphibian	Triturus cristatus	Great crested newt	HR 1994	Schedule 2: European protected species
Bird	Gavia immer	Great Northern diver	WCA 1981	Schedule 1 (Part I)
Vascular Plant	Rhinanthus angustifolius	Greater yellow-rattle	WCA 1981	Schedule 8
Bird	Tringa ochropus	Green sandpiper	WCA 1981	Schedule 1 (Part I)
Moss	Buxbaumia viridis	Green shield-moss	WCA 1981	Schedule 8
Reptile	Chelonia mydas	Green turtle	HR 1994	Schedule 2: European protected species
Bird	Carduelis chloris	Greenfinch	WCA 1981	Schedule 3 (Part I)
Bird	Tringa nebularia	Greenshank	WCA 1981	Schedule 1 (Part I)
Mammal	Halichoerus grypus	Grey seal	HR 1994	Schedule 3
Bird	Anser anser	Greylag goose	WCA 1981	Schedule 1 (Part I in Outer Hebrides, Caithness & Sutherland and Wester Ross only)
Bird	Anser anser	Greylag goose	WCA 1981	Schedule 1 (Part II in Outer Hebrides, Caithness & Sutherland and Wester Ross only)
Bird	Anser anser	Greylag goose	WCA 1981	Schedule 2
Bird	Falco rusticolus	Gyr falcon	WCA 1981	Schedule 1 (Part I)
Mammal	Phoca groenlandica (otherwise known as Pagophilus groenlandicus)	Harp seal	HR 1994	Schedule 3
Bird	Circus spp	Harriers (all species)	WCA 1981	Schedule 1 (Part I)
Reptile	Eretmochelys imbricata	Hawksbill turtle	HR 1994	Schedule 2: European protected species
Mammal	Erinaceus europaeus	Hedgehog	WCA 1981	Schedule 6
Bird	Circus cyaneus	Hen harrier	WCA 1981	Schedule 1 (Part I)
Bird	Circus cyaneus	Hen harrier	WCA 1981	Schedule 1A
Bird	Falco subbuteo	Hobby	WCA 1981	Schedule 1 (Part I)
Bird	Pernis apivorus	Honey buzzard	WCA 1981	Schedule 1 (Part I)
Bird	Pernis apivorus	Honey buzzard	WCA 1981	Schedule 4
Mammal	Cystophora cristata	Hooded seal	HR 1994	Schedule 3
Bird	Upupa epops	Hoopoe	WCA 1981	Schedule 1 (Part I)
Bird	Corvus monedula	Jackdaw	WCA 1981	Schedule 3 (Part I)
Bird	Garrulus glandarius	Jay	WCA 1981	Schedule 3 (Part I)
Reptile	Lepidochelys kempii	Kemp's ridley turtle	HR 1994	Schedule 2: European protected species
Vascular Plant	Trichomanes speciosum	Killarney fern	HR 1994	Schedule 4: European protected species

Bird	<i>Alcedo atthis</i>	Kingfisher	WCA 1981	Schedule 1 (Part I)
Bird	<i>Calcarius lapponicus</i>	Lapland bunting	WCA 1981	Schedule 1 (Part I)
Vascular Plant	<i>Dactylorhiza traunsteineroides</i> ssp <i>lapponica</i>	Lapland marsh-orchid	WCA 1981	Schedule 8
Butterfly	<i>Coenonympha tullia</i>	Large heath	WCA 1981	Schedule 5 ⁴
Moss	<i>Scorpidium turgescens</i>	Large yellow feather-moss	WCA 1981	Schedule 8
Bird	<i>Oceanodroma leucorhoa</i>	Leach's petrel	WCA 1981	Schedule 1 (Part I)
Reptile	<i>Dermochelys coriacea</i>	Leatherback turtle	HR 1994	Schedule 2: European protected species
Liverwort	<i>Adelanthus lindenbergianus</i>	Lindenberg's leafy liverwort	WCA 1981	Schedule 8
Bird	<i>Carduelis cannabina</i>	Linnet	WCA 1981	Schedule 3 (Part I)
Bird	<i>Larus minutus</i>	Little gull	WCA 1981	Schedule 1 (Part I)
Bird	<i>Charadrius dubius</i>	Little ringed plover	WCA 1981	Schedule 1 (Part I)
Bird	<i>Sterna albifrons</i>	Little tern	WCA 1981	Schedule 1 (Part I)
Reptile	<i>Caretta caretta</i>	Loggerhead turtle	HR 1994	Schedule 2: European protected species
Moss	<i>Anomodon longifolius</i>	Long-leaved anomodon	WCA 1981	Schedule 8
Moss	<i>Bryum neodamense</i>	Long-leaved thread-moss	WCA 1981	Schedule 8
Bird	<i>Clangula hyemalis</i>	Long-tailed duck	WCA 1981	Schedule 1 (Part I)
Bird	<i>Pica pica</i>	Magpie	WCA 1981	Schedule 3 (Part I)
Bird	<i>Anas platyrhynchos</i>	Mallard	WCA 1981	Schedule 2
Bird	<i>Anas platyrhynchos</i>	Mallard	WCA 1981	Schedule 3 (Part III)
Liverwort	<i>Jamesoniella undulifolia</i>	Marsh earwort	WCA 1981	Schedule 8
Butterfly	<i>Euphydryas aurinia</i>	Marsh fritillary	WCA 1981	Schedule 5
Bird	<i>Circus aeruginosus</i>	Marsh harrier	WCA 1981	Schedule 1 (Part I)
Bird	<i>Circus aeruginosus</i>	Marsh harrier	WCA 1981	Schedule 4
Annelid worm	<i>Hirudo medicinalis</i>	Medicinal leech	WCA 1981	Schedule 5
Bird	<i>Larus melanocephalus</i>	Mediterranean gull	WCA 1981	Schedule 1 (Part I)
Bird	<i>Falco columbarius</i>	Merlin	WCA 1981	Schedule 1 (Part I)
Bird	<i>Falco columbarius</i>	Merlin	WCA 1981	Schedule 4
Bird	<i>Circus pygargus</i>	Montagu's harrier	WCA 1981	Schedule 1 (Part I)
Bird	<i>Circus pygargus</i>	Montagu's harrier	WCA 1981	Schedule 4
Bird	<i>Gallinula chloropus</i>	Moorhen	WCA 1981	Schedule 2
Mammal	<i>Lepus timidus</i>	Mountain hare	HR 1994	Schedule 3
Butterfly	<i>Erebia epiphron</i>	Mountain ringlet	WCA 1981	Schedule 5 ⁴
Amphibian	<i>Bufo calamita</i>	Natterjack toad	HR 1994	Schedule 2: European protected species
Liverwort	<i>Leiocolea rutheana</i>	Norfolk flapwort	WCA 1981	Schedule 8
Butterfly	<i>Aricia artaxerxes</i>	Northern brown argus	WCA 1981	Schedule 5 ⁴
Mollusc	<i>Thyasira gouldi</i>	Northern hatchet-shell	WCA 1981	Schedule 5
Vascular Plant	<i>Hieracium northroense</i>	Northroe hawkweed	WCA 1981	Schedule 8
Vascular Plant	<i>Arenaria norvegica</i>	Norwegian sandwort	WCA 1981	Schedule 8
Fungi	<i>Piptoporus quercinus</i>	Oak polypore	WCA 1981	Schedule 8
Vascular Plant	<i>Woodsia ilvensis</i>	Oblong woodsia	WCA 1981	Schedule 8
Lichen	<i>Parmentaria chilensis</i>	Oil-stain parmentaria	WCA 1981	Schedule 8
Lichen	<i>Caloplaca luteoalba</i>	Orange-fruited elm-lichen	WCA 1981	Schedule 8
Bird	<i>Pandion haliaetus</i>	Osprey	WCA 1981	Schedule 1 (Part I)
Bird	<i>Pandion haliaetus</i>	Osprey	WCA 1981	Schedule 4
Mammal	<i>Lutra lutra</i>	Otter	HR 1994	Schedule 2: European protected species
Amphibian	<i>Triturus helveticus</i>	Palmate newt	WCA 1981	Schedule 5 ⁴
Butterfly	<i>Boloria euphrosyne</i>	Pearl-bordered fritillary	WCA 1981	Schedule 5 ⁴
Bird	<i>Falco peregrinus</i>	Peregrine falcon	WCA 1981	Schedule 1 (Part I)
Bird	<i>Falco peregrinus</i>	Peregrine falcon	WCA 1981	Schedule 4
Liverwort	<i>Petalophyllum ralfsii</i>	Petalwort	WCA 1981	Schedule 8

Vascular Plant	Crassula aquatica	Pigmyweed	WCA 1981	Schedule 8
Mammal	Martes martes	Pine marten	HR 1994	Schedule 3
Mammal	Martes martes	Pine marten	WCA 1981	Schedule 5
Bird	Anser brachyrhynchus	Pink-footed goose	WCA 1981	Schedule 2
Bird	Anas acuta	Pintail	WCA 1981	Schedule 1 (Part II)
Bird	Anas acuta	Pintail	WCA 1981	Schedule 2
Bird	Anas acuta	Pintail	WCA 1981	Schedule 3 (Part III)
Bird	Aythya ferina	Pochard	WCA 1981	Schedule 2
Bird	Aythya ferina	Pochard	WCA 1981	Schedule 3 (Part III)
Liverwort	Gymnomitrium apiculatum	Pointed frostwort	WCA 1981	Schedule 8
Moss	Hygrohypnum polare	Polar feather-moss	WCA 1981	Schedule 8
Mammal	Mustela putorius (otherwise known as Putorius putorius)	Polecat	HR 1994	Schedule 3
Vascular Plant	Homogyne alpina	Purple colts-foot	WCA 1981	Schedule 8
Bird	Ardea purpurea	Purple heron	WCA 1981	Schedule 1 (Part I)
Bird	Calidris maritima	Purple sandpiper	WCA 1981	Schedule 1 (Part I)
Bird	Coturnix coturnix	Quail	WCA 1981	Schedule 1 (Part I)
Lichen	Pseudocyphellaria lacerata	Ragged pseudocyphellaria	WCA 1981	Schedule 8
Bird	Milvus milvus	Red kite	WCA 1981	Schedule 1 (Part I)
Bird	Milvus milvus	Red kite	WCA 1981	Schedule 1A
Mammal	Sciurus vulgaris	Red squirrel	WCA 1981	Schedule 5
Mammal	Sciurus vulgaris	Red squirrel	WCA 1981	Schedule 6
Bird	Lanius collurio	Red-backed shrike	WCA 1981	Schedule 1 (Part I)
Bird	Phalaropus lobatus	Red-necked phalarope	WCA 1981	Schedule 1 (Part I)
Bird	Carduelis flammea	Redpoll	WCA 1981	Schedule 3 (Part I)
Bird	Gavia stellata	Red-throated diver	WCA 1981	Schedule 1 (Part I)
Bird	Turdus iliacus	Redwing	WCA 1981	Schedule 1 (Part I)
Bird	Emberiza schoeniclus	Reed bunting	WCA 1981	Schedule 3 (Part I)
Mammal	Phoca hispida (otherwise known as Pusa hispida)	Ringed seal	HR 1994	Schedule 3
Lichen	Collema dichotomum	River jelly-lichen	WCA 1981	Schedule 8
Fish	Lampetra fluviatilis	River lamprey	HR 1994	Schedule 3
Vascular Plant	Potentilla rupestris	Rock cinquefoil	WCA 1981	Schedule 8
Bird	Sterna dougallii	Roseate tern	WCA 1981	Schedule 1 (Part I)
Bird	Carpodacus erythrinus	Rosefinch	WCA 1981	Schedule 1 (Part I)
Vascular Plant	Althaea hirsuta	Rough marsh-mallow	WCA 1981	Schedule 8
Bird	Philomachus pugnax	Ruff	WCA 1981	Schedule 1 (Part I)
Lichen	Psora rubiformis	Rusty alpine spora	WCA 1981	Schedule 8
Bird	Aythya marila	Scaup	WCA 1981	Schedule 1 (Part I)
Moss	Bryum schleicheri	Schleicher's thread-moss	WCA 1981	Schedule 8
Bird	Serinus serinus	Serin	WCA 1981	Schedule 1 (Part I)
Vascular Plant	Hieracium zetlandicum	Shetland hawkweed	WCA 1981	Schedule 8
Bird	Eremophila alpestris	Shore lark	WCA 1981	Schedule 1 (Part I)
Bird	Anas clypeata	Shoveler	WCA 1981	Schedule 2
Bird	Anas clypeata	Shoveler	WCA 1981	Schedule 3 (Part III)
Mammal	Sorex spp	Shrews (all species)	WCA 1981	Schedule 6
Bird	Carduelis spinus	Siskin	WCA 1981	Schedule 3 (Part I)
Bird	Podiceps auritus	Slavonian grebe	WCA 1981	Schedule 1 (Part I)
Moss	Hamatocaulis (Drepanocladus) vernicosus	Slender green feather-moss	WCA 1981	Schedule 8
Vascular Plant	Najas flexilis	Slender naiad	HR 1994	Schedule 4: European protected species
Reptile	Anguis fragilis	Slow worm	WCA 1981	Schedule 5 ^{1,4}
Vascular Plant	Alyssum alyssoides	Small Alison	WCA 1981	Schedule 8
Butterfly	Cupido minimus	Small blue	WCA 1981	Schedule 5 ⁴
Vascular Plant	Pulicaria vulgaris	Small fleabane	WCA 1981	Schedule 8

Vascular Plant	<i>Ononis reclinata</i>	Small restharrow	WCA 1981	Schedule 8
Amphibian	<i>Triturus vulgaris</i>	Smooth newt	WCA 1981	Schedule 5 ⁴
Bird	<i>Plectrophenax nivalis</i>	Snow bunting	WCA 1981	Schedule 1 (Part I)
Lichen	<i>Caloplaca nivalis</i>	Snow caloplaca	WCA 1981	Schedule 8
Bird	<i>Nyctea scandiaca</i>	Snowy owl	WCA 1981	Schedule 1 (Part I)
Bird	<i>Turdus philomelos</i>	Song thrush	WCA 1981	Schedule 3 (Part I)
Bird	<i>Platalea leucorodia</i>	Spoonbill	WCA 1981	Schedule 1 (Part I)
Bird	<i>Porzana porzana</i>	Spotted crane	WCA 1981	Schedule 1 (Part I)
Bird	<i>Sturnus vulgaris</i>	Starling	WCA 1981	Schedule 3 (Part I)
Vascular Plant	<i>Chenopodium vulvaria</i>	Stinking goosefoot	WCA 1981	Schedule 8
Fish	<i>Acipenser sturio</i>	Sturgeon	HR 1994	Schedule 2: European protected species
Crustacean	<i>Triops cancriformis</i>	Tadpole shrimp/Apus	WCA 1981	Schedule 5
Lichen	<i>Lecanora achariana</i>	Tarn lecanora	WCA 1981	Schedule 8
Bird	<i>Anas crecca</i>	Teal	WCA 1981	Schedule 2
Bird	<i>Anas crecca</i>	Teal	WCA 1981	Schedule 3 (Part III)
Bird	<i>Calidris temminckii</i>	Temminck's stint	WCA 1981	Schedule 1 (Part I)
Lichen	<i>Catapyrenium psoromoides</i>	Tree catapyrenium	WCA 1981	Schedule 8
Bird	<i>Aythya fuligula</i>	Tufted duck	WCA 1981	Schedule 2
Bird	<i>Aythya fuligula</i>	Tufted duck	WCA 1981	Schedule 3 (Part III)
Vascular Plant	<i>Saxifraga cespitosa</i>	Tufted saxifrage	WCA 1981	Schedule 8
Liverwort	<i>Geocalyx graveolens</i>	Turpswort	WCA 1981	Schedule 8
Fish	<i>Alosa fallax</i>	Twaite shad	HR 1994	Schedule 3
Fish	<i>Alosa fallax</i>	Twaite shad	WCA 1981	Schedule 5 ^{3a}
Bird	<i>Carduelis flavirostris</i>	Twite	WCA 1981	Schedule 3 (Part I)
Lichen	<i>Cladonia trassii</i>	Upright mountain-cladonia	WCA 1981	Schedule 8
Moss	<i>Hypnum vaucheri</i>	Vaucher's feather-moss	WCA 1981	Schedule 8
Bird	<i>Melanitta fusca</i>	Velvet scoter	WCA 1981	Schedule 1 (Part I)
Fish	<i>Coregonus albula</i>	Vendace	HR 1994	Schedule 3
Fish	<i>Coregonus albula</i>	Vendace	WCA 1981	Schedule 5
Reptile	<i>Zootoca vivipara</i>	Viviparous lizard	WCA 1981	Schedule 5 ^{1,4}
Mammal	<i>Arvicola terrestris</i>	Water vole	WCA 1981	Schedule 5 ³
Vascular Plant	<i>Hieracium attenuatifolium</i>	Weak-leaved hawkweed	WCA 1981	Schedule 8
Bird	<i>Numenius phaeopus</i>	Whimbrel	WCA 1981	Schedule 1 (Part I)
Bird	<i>Gavia adamsii</i>	White-billed diver	WCA 1981	Schedule 1 (Part I)
Fish	<i>Coregonus lavaretus</i>	Whitefish	HR 1994	Schedule 3
Fish	<i>Coregonus lavaretus</i>	Whitefish	WCA 1981	Schedule 5
Bird	<i>Anser albifrons</i>	White-fronted goose	WCA 1981	Schedule 2
Bird	<i>Haliaeetus albicilla</i>	White-tailed eagle	WCA 1981	Schedule 1 (Part I)
Bird	<i>Haliaeetus albicilla</i>	White-tailed eagle	WCA 1981	Schedule 1A
Bird	<i>Haliaeetus albicilla</i>	White-tailed eagle	WCA 1981	Schedule 4
Bird	<i>Haliaeetus albicilla</i>	White-tailed eagle	WCA 1981	Schedule A1
Bird	<i>Cygnus cygnus</i>	Whooper swan	WCA 1981	Schedule 1 (Part I)
Vascular Plant	<i>Polygonatum verticillatum</i>	Whorled Solomon's-seal	WCA 1981	Schedule 8
Bird	<i>Anas penelope</i>	Wigeon	WCA 1981	Schedule 2
Bird	<i>Anas penelope</i>	Wigeon	WCA 1981	Schedule 3 (Part III)
Mammal	<i>Felis silvestris</i>	Wildcat	HR 1994	Schedule 2: European protected species
Bird	<i>Tringa glareola</i>	Wood sandpiper	WCA 1981	Schedule 1 (Part I)
Bird	<i>Scolopax rusticola</i>	Woodcock	WCA 1981	Schedule 2
Bird	<i>Scolopax rusticola</i>	Woodcock	WCA 1981	Schedule 3 (Part III)
Bird	<i>Columba palumbus</i>	Woodpigeon	WCA 1981	Schedule 3 (Part II)
Bird	<i>Jynx torquilla</i>	Wryneck	WCA 1981	Schedule 1 (Part I)
Vascular Plant	<i>Saxifraga hirculus</i>	Yellow marsh saxifrage	HR 1994	Schedule 4: European protected species
Bird	<i>Emberiza citrinella</i>	Yellowhammer	WCA 1981	Schedule 3 (Part I)

Vascular Plant	Epipactis youngiana	Young's helleborine	WCA 1981	Schedule 8
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Key

WCA 1981	Wildlife & Countryside Act 1981 (as amended in Scotland)
	Schedule 1 (Part I) Birds protected by special penalties
	Schedule 1 (Part II) Birds protected by special penalties during the closed season
	Schedule 1A Birds that may not be intentionally or recklessly harassed at any time
	Schedule A1 Birds whose habitually used nests may not be intentionally or recklessly taken, damaged, destroyed or otherwise interfered with when not in use
	Schedule 2 Birds which may be killed or taken outside the closed season
	Schedule 3 (Part I) Birds which may be sold at all times if ringed and kept in captivity
	Schedule 3 (Part II) Birds that may be sold dead at all times
	Schedule 3 (Part III) Birds that may be sold dead from 1 September to 28 February
	Schedule 4 Birds that must be registered and ringed if kept in captivity
	Schedule 5 Protected animals
	Schedule 6 Animals protected from prohibited methods of capture
	Schedule 8 Protected plants

HR 1994 Habitats Regulations 1994 (as amended in Scotland)

PBA 1992 Protection of Badgers Act 1992

¹ Protected against intentional killing and injuring

² Protected against intentional or reckless taking

³ Protected against intentional or reckless damage to, destruction of, obstruction of access to any structure or place used for shelter or protection and disturbance to animal whilst occupying such structures

^{3a} Protected against intentional or reckless damage to, destruction of, obstruction of access to any structure or place used for shelter or protection

⁴ Protected against selling, offering or advertising for sale, possessing or transporting for the purpose of sale

⁵ Protected against possession or control (live or dead animal, part or derivative)

Protected in England & Wales only (a species believed to have been introduced to Scotland)

TECHNICAL APPENDIX 7.3: SITE PHOTOGRAPHS



Photo 1. Docherniel Burn: Water crossing (Target Note 14)



Photo 2. Docherniel Burn: Downstream (Target Note 14)

Title: Appendix 7.3	Client: SPEN
Site: Tralorg	Date: 10/10/2018



Photo 3. Docherniel Burn: Upstream (Target Note 14)



Photo 4. Muck Water: Overview (Target Note 19)

Title: Appendix 7.3	Client: SPEN
Site: Tralorg	Date: 10/10/2018



Photo 5. Muck Water: Downstream (Target Note 19)



Photo 6. Muck Water: Upstream (Target Note 19)

Title: Appendix 7.3	Client: SPEN
Site: Tralorg	Date: 10/10/2018



Photo 7. Potential great crested newt pond (Target Note 16)



Photo 8. Potential great crested newt pond (Target Note 22)

Title: Appendix 7.3	Client: SPEN
Site: Tralorg	Date: 10/10/2018



Photo 9. Wet area in marshy grassland

Title: Appendix 7.3	Client: SPEN
Site: Tralorg	Date: 10/10/2018

TECHNICAL APPENDIX 7.4: TECHNICAL REPORT – ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GCN

Folio No: E2411
Report No: 1
Order No: UK12-23166
Client: RAMBOLL ENVIRONMENTAL
Contact: Nadine Little
Contact Details: nlittle@ramboll.com
Date: 26/04/2018

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GREAT CRESTED NEWTS

Date sample received at Laboratory: 24/04/2018
Date Reported: 26/04/2018
Matters Affecting Results: None

RESULTS

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
0065	Tralorg, Pond 3	NX 24394 87404	Pass	Pass	Pass	Negative	0
0066	Tralorg, Pond 1	NX 23818 88159	Pass	Pass	Pass	Negative	0
0068	Tralorg, Pond 2	NX 24256 87655	Pass	Pass	Pass	Negative	0
0071	Tralorg, Pond 4	NX 23932 87141	Pass	Pass	Pass	Negative	0

SUMMARY

When Great Crested Newts (GCN); *Triturus cristatus* inhabit a pond, they deposit traces of their DNA in the water as evidence of their presence. By sampling the water, we can analyse these small environmental DNA (eDNA) traces to confirm GCN habitation, or establish GCN absence.

The water samples detailed below were submitted for eDNA analysis to the protocol stated in DEFRA WC1067 (Latest Amendments). Details on the sample submission form were used as the unique sample identity.

RESULTS INTERPRETATION

Lab Sample No.- When a kit is made it is given a unique sample number. When the pond samples have been taken and the kit has been received back in to the laboratory, this sample number is tracked throughout the laboratory.

Site Name- Information on the pond.

O/S Reference - Location/co-ordinates of pond.

SIC- Sample Integrity Check. Refers to quality of packaging, absence of tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to results errors. Inspection upon receipt of sample at the laboratory. To check if the Sample is of adequate integrity when received. Pass or Fail.

DC- Degradation Check. Analysis of the spiked DNA marker to see if there has been degradation of the kit since made in the laboratory to sampling to analysis. Pass or Fail.

IC- Inhibition Check- PCR inhibitors can cause false results. Inhibitors are analysed to check the quality of the result. Every effort is made to clean the sample pre-analysis however some inhibitors cannot be extracted. An unacceptable inhibition check will cause an indeterminate sample and must be sampled again.

Result- NEGATIVE means that GCN eDNA was not detected or is below the threshold detection level and the test result should be considered as no evidence of GCN presence. POSITIVE means that GCN eDNA was found at or above the threshold level and the presence of GCN at this location at the time of sampling or in the recent past is confirmed. Positive or Negative.

Positive Replicates- To generate the results all of the tubes from each pond are combined to produce one eDNA extract. Then twelve separate analyses are undertaken. If one or more of these analyses are positive the pond is declared positive for the presence of GCN. It may be assumed that small fractions of positive analyses suggest low level presence but this cannot currently be used for population studies. In accordance with Natural England protocol, even a score of 1/12 is declared positive.

METHODOLOGY

The laboratory testing adheres to strict guidelines laid down in WC1067 Analytical and Methodological Development for Improved Surveillance of The Great Crested Newt, Version 1.1

The analysis is conducted in two phases. The sample first goes through an extraction process where all six tubes are pooled together to acquire as much eDNA as possible. The pooled sample is then tested via real time PCR (also called q-PCR). This process amplifies select part of DNA allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines PCR amplification and detection into a single step. This eliminates the need to detect products using gel electrophoresis. With qPCR, fluorescent dyes specific to the target sequence are used to label PCR products during thermal cycling. The accumulation of fluorescent signals during the exponential phase of the reaction is measured for fast and objective data analysis. The point at which amplification begins (the Ct value) is an indicator of the quality of the sample. True positive controls, negatives and blanks as well as spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared so they act as additional quality control measures.

The primers used in this process are specific to a part of mitochondrial DNA only found in GCN ensuring no DNA from other species present in the water is amplified. The unique sequence appropriate for GCN analysis is quoted in DEFRA WC 1067 and means there should be no detection of closely related species. We have tested our system exhaustively to ensure this is the case in our laboratory. We can offer eDNA analysis for most other species including other newts.

Analysis of eDNA requires scrupulous attention to detail to prevent risk of contamination. Kits are manufactured by SureScreen Scientifics to strict quality procedures in a separate building and with separate staff, adopting best practice from WC1067 and WC1067 Appendix 5. Kits contain a 'spiked' DNA marker used as a quality control tracer (SureScreen patent pending) to ensure any DNA contained in the sampled water has not deteriorated in transit. Stages of the DNA analysis are also conducted in different buildings at our premises for added

SureScreen Scientifics Ltd also participate in Natural England's proficiency testing scheme and we also carry out inter-laboratory checks on accuracy of results as part of our quality procedures.

Reported by: Derry Hickman

Approved by: Troy Whyte

End Of Report

TECHNICAL APPENDIX 7.5: CONFIDENTIAL ORNITHOLOGY SURVEY RESULTS

8. HYDROLOGY AND HYDROGEOLOGY APPRAISAL

8.1 Introduction

This chapter identifies the likely impacts on hydrology and soils associated with the construction and operation of the proposed development, and, provides details of control measures where appropriate. The specific objectives of the chapter are to:

- describe the baseline environment;
- identify the potential direct and indirect impacts on hydrology and soil receptors; and
- describe any mitigation or control measures proposed to address likely impacts.

A detailed watercourse survey report is provided in Appendix 8.1, while Appendix 8.2 considers the potential for impact on the groundwater abstractions and groundwater flow connected to areas of potential Groundwater Dependent Terrestrial Ecosystems (GWDTE).

Figures 8.1 – 8.3 are referenced in the text where relevant.

8.2 Methodology

8.2.1 Desk Study

The desk study consisted of a review of the proposed OHL and underground cable alignment and the identification of watercourses that would potentially be crossed by the proposed development, including those marked on the 1: 50,000 scale OS map data. Watercourses were also identified using higher resolution 1:25,000 scale OS map data to ensure the survey work included potential crossings over minor headwater channels.

8.2.2 Study Area

The study area for direct effects on the water environment associated with the construction phase of the proposed development equates to a 30 m radius from the edge of each watercourse identified on the Ordnance Survey 1:25,000 scale mapping. Consideration was also given to downstream effects within the same catchment. Figure 8.1 shows the relevant watercourses and the 30 m radius around each of these, which are crossed by the proposed development.

8.2.3 Site Visit

A survey of the watercourses that would be crossed by the proposed development was undertaken to gain a more detailed understanding of the sensitivities associated with each. The locations where the proposed OHL and the underground cable cross watercourses were recorded by using ArcPad on Trimble Juno®, by using its Geographical Position System (GPS). Photographs and field notes were taken, reporting the dimensions of the watercourse channel and flood channel (where apparent), flow, instream vegetation and the type of substrate. The surveyed watercourse crossings vary from small headwater crossings to larger stream and river crossings.

The site survey was carried out on 12th & 13th March 2018; the weather conditions during the visit were dry with a temperature between 3 and 9 degrees Celsius. Due to a slight amendment to the route, a follow-up visit was carried out on 23rd April 2018 (temperature between 4 and 9 degrees Celsius) to survey two additional locations (crossing 30 and 31).

8.3 Baseline Conditions

8.3.1 Watercourses

The following larger watercourses are located within 30 m of the proposed development:

- Water of Assel, which has been classified as having an overall status of Good with Medium confidence in 2008 with overall ecological status of Good and overall chemical status of Pass;
- River Stinchar, which has been classified as having an overall status of Good with Medium confidence in 2008 with overall ecological status of Good and overall chemical status of Pass; and
- Muck Water, which has been classified as having an overall status of Good with High confidence in 2008 with overall ecological status of Good and overall chemical status of Pass.

The watercourses described in the following sections were identified during the site visit. In addition, it is likely that a range of other small natural ephemeral channels, artificial drainage channels and flushes would be encountered post consent prior to construction, during the detailed site investigation and design stage.

Overhead Line

Twenty-one locations were identified on the OS 1:25,000 scale digital mapping (Figure 8.2), where the proposed OHL would cross watercourses. No additional watercourse crossing locations were identified during the site survey. Some of the watercourses in the area are very minor natural or artificial channels.

The survey identified no concentrations of fish or amphibian prey at the locations where the proposed development would cross the watercourses or within habitats upstream of these locations.

Underground Cable

Six locations where the underground cable would cross watercourses were identified on the OS 1:25,000 scale digital mapping.

Table A8.1 (Appendix 8.1) provides a summary of the surveyed watercourses. More detailed information on the watercourse crossings identified on the 1:25,000 scale digital mapping and during the site visit is also provided in Appendix 8.1, including photographs and hydromorphological information associated with each location.

The survey identified no concentrations of fish or amphibian prey at the locations where the proposed development would cross the watercourses or within habitats upstream of these locations.

8.3.2 Flood Risk

The online SEPA Flood Risk Management Map¹ indicates that the majority of the proposed development does not lie within any areas that have been identified as being at risk from flooding. Areas of high and medium flood risk² have been identified, along the banks of the Water of Assel, the River Stinchar and Muck Water.

8.3.3 Groundwater Dependent Terrestrial Ecosystems

Potential GWDTEs are identified along the route, associated with some wet heath and marshy grassland communities. However, due to the ecological and hydrological/hydrogeological

¹ Available at <http://map.sepa.org.uk/floodmap/map.htm>, accessed 04/07/2018

² High risk equates to likelihood of a 1 in 10-year flood event, while medium risk equates to likelihood of a 1 in 200-year flood event.

regimes in the area, the majority of these potential GWDTEs are not considered to be sensitive receptors. Four areas of potential GWDTE are identified as potentially sensitive and further risk assessment of the potential impact on these areas has been completed, which has confirmed that potential impacts are likely to be negligible. Further information in regard to GWDTEs is provided in Appendix 8.2.

8.3.4 Private Water Supplies

Four private water supplies (PWS) are identified within 250 m of the proposed development. A PWS risk assessment has been completed in order to identify potential impacts from the proposed development on these PWS; the PWS risk assessment is provided in Appendix 8.2.

8.3.5 Soils

The British Geological Society (BGS) 50K bedrock geology data³, indicates that the proposed development is underlain by rocks forming part of the Leadhills Supergroup, the Tappins Group and the Kirkcolm Formation.

The British Geological Society (BGS) 1:625k scale hydrogeological data⁴, indicates that all of the bedrock formations comprise low productivity aquifers with small amounts of groundwater in near surface weathered zones and fractures.

Areas of peatland are located in the southern section of proposed development, west of the proposed development and east of the forestry area between Pinmore Mains and Glake (Figure 8.3).

8.4 Potential Impacts and Mitigation

8.4.1 Construction

Potential effects during construction are detailed in Table 8.1 below, which also details the relevant receptor and mitigation or control measures, where appropriate.

³ <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

⁴ <http://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSHydroMap>

Table 8.1: Potential Impacts on Hydrology and Hydrogeology during Construction and Relevant Mitigation/Control Measures		
Potential Impact	Receptor	Mitigation/Control Measures Proposed
Compaction and soil erosion along the route, including temporary construction compounds.	Soils and peatland	<p>No access tracks would form part of the OHL section of the proposed development; access to the pole locations would be obtained either by foot or by using track mats and low ground pressure vehicles, in order to prevent potential effects on the habitats identified within the study area.</p> <p>Temporary access tracks will be required for the underground cable section of the proposed development. These tracks would be temporary stone tracks approximately 3 m in width. Best practice measures to control compaction and soil erosion caused by temporary access during construction would be set out in the construction phase Environmental Management Plan (EMP).</p>
Siltation or pollution of watercourses during excavation and installation of wood poles.	Watercourses	No engineering works are anticipated within any of the watercourses identified. Therefore, works will not result in any alterations to the beds and banks of the watercourses and low pressure tracked excavators would be used for wood pole construction.
Spills from temporary construction compounds causing pollution of watercourses.	Watercourses	Where pole installation is required within 30 m of a watercourse, good practice silt management – which would be outlined in the EMP – would be put in place, with nearby watercourses checked during periods of high rainfall during construction activities. Ground excavation work would temporarily stop work during periods of high rainfall.
Watercourse crossings leading to siltation or pollution if good practice not followed.	Watercourses	Any underground cable watercourse crossings would require authorisation under <i>The Water Environmental (Controlled Activities) (Scotland) Regulations 2011 (CAR)</i> . Open-cutting with flume crossing would generally be used on any underground cable or temporary stone track watercourse crossings. Damming and over-pumping may be required depending on water flow at the time of the crossing. Construction techniques would be outlined in the EMP and proposed crossing techniques / methods would be discussed and agreed with SEPA through CAR authorisation.
Modification of groundwater flows by location of wood poles and/or by excavation of cable trench, forming a preferential flow path for sub-surface flows. In addition, any excavations below the groundwater level along the length of the cable route could lead to a localised groundwater drawdown.	Groundwater flow	<p>The wood pole installation and cabling process would ensure that the trench design incorporates drainage design measures to ensure the discharge would not result in pollution to surface water; this would be set out in the EMP. Water within the trench would be pumped to a suitable settlement pond, prior to either infiltration or discharge.</p> <p>All underground cable watercourse crossings would require authorisation under <i>The Water Environmental (Controlled Activities) (Scotland) Regulations 2011 (CAR)</i>.</p>

Table 8.1: Potential Impacts on Hydrology and Hydrogeology during Construction and Relevant Mitigation/Control Measures		
Potential Impact	Receptor	Mitigation/Control Measures Proposed
Contamination from materials/wastes handled or stored at the temporary construction compounds.	Soils and peatland	<p>All excavated material would be carefully stored a minimum of 30 m away from any watercourse, with particular care taken to preserve the integrity of soil structure and prevent any risk of runoff or sediment blow-off into watercourses.</p> <p>Temporary construction compounds will be kept to the minimum necessary for safe implementation of the works. On-site storage of oil and fuels will be avoided if possible but where on-site storage is required, the volumes to be stored would be minimised and stored in accordance with all applicable legislation and good practice.</p>
Pollution of private water supplies during excavation and installation of wood poles and underground cabling.	Private water supplies	<p>No refuelling or storage of equipment, materials, chemicals or standing machinery to occur within 250 m of the PWS;</p> <p>Initial inspection/ sampling prior to commencement of works, in order to establish existing water quality in the area;</p> <p>Water quality monitoring/sampling for the duration of construction activities in the vicinity of the PWS in order to ensure that any pollution incident is immediately identified and rectified;</p> <p>Emergency Response Procedures to be detailed within the EMP and implemented in the event of spillage or incident during the construction period. The local residents should be notified immediately in the event of spillage or incident within 250 m of the PWS;</p> <p>Final closedown inspection/ sampling prior to leaving affected area; and</p> <p>Contractors will be required to integrate any mitigation measures developed from the PWS risk assessment, and industry best practice, into the EMP and site documentation to ensure the protection of PWSs in terms of quality and quantity of supply.</p>

8.4.3 Operation

Potential effects during operation are detailed in Table 8.2 below, which also details the relevant receptor and mitigation or control measures, where appropriate.

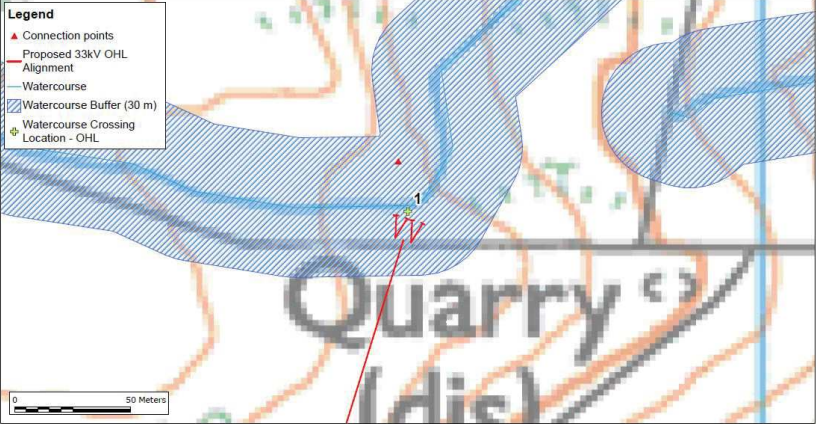


Table 8.2: Potential Impacts on Hydrology and Hydrogeology during Operation and Relevant Mitigation/Control Measures		
Potential Impact	Receptor	Mitigation/Control Measures Proposed
Interception of groundwater / interflow by the underground cable trench.	Groundwater	The design of the proposed development has avoided hydrologically sensitive areas where possible and has ensured appropriate buffer distances between construction elements and watercourses. This would minimise the risk of alterations to surface and groundwater flow patterns, water pollution and increased sediment loading during both construction and operational phases.
Risk of minor leaks of fuel and hydraulic oil from maintenance vehicles.	Surface water, groundwater and soils	

TECHNICAL APPENDIX 8 – HYDROLOGY AND HYDROGEOLOGY APPRAISAL

- 8.1: Watercourse Crossing Assessment
- 8.2: Groundwater Abstraction and Groundwater Dependent Terrestrial Ecosystem (GWDTE) Appraisal

TECHNICAL APPENDIX 8.1: WATERCOURSE CROSSING ASSESSMENT

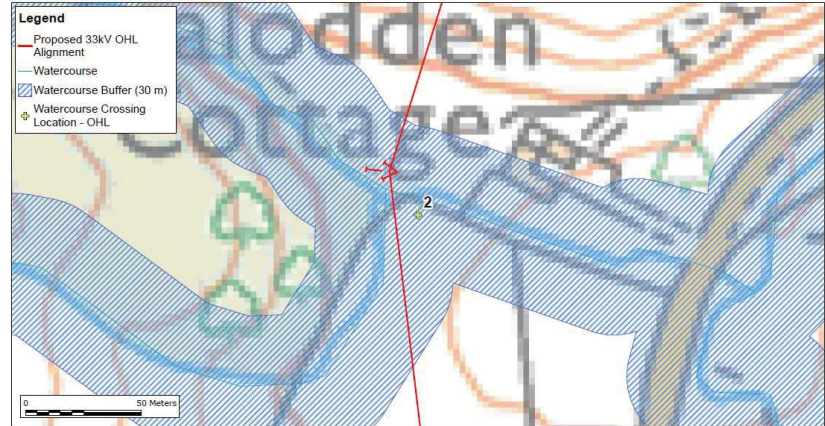
Table A8.1: Summary of Watercourse Crossings			
ID	Section	Easting	Northing
1	OHL	222847	596833
2	OHL	222683	596242
3	OHL	222769	595692
4	OHL	223034	595109
5	OHL	223111	594730
6	OHL	222997	594125
7	OHL	222976	594108
8	OHL	222964	594084
9	OHL	222754	593928
10	OHL	222644	593834
11	OHL	222072	593572
12	OHL	221560	593111
13	OHL	221293	592736
14	OHL	221252	592648
15	OHL	221238	592613
16	OHL	221175	592480
17	OHL	221260	591809
18	OHL	221251	591393
19	OHL	221347	591105
20	OHL	221523	590817
21	OHL	222121	589771
22	Underground Cable	222435	589432
23	Underground Cable	223663	588622
24	Underground Cable	223810	588139
25	Underground Cable	223963	587895
26	Underground Cable	223995	587804
27	Underground Cable	223515	586938

WC 1	
Description	
Watercourse width	1.5 m
Watercourse depth	0.1 m
Channel width	2 m
Substrate	Sandy gravel
Instream Vegetation	No
Gradient	Moderate
	
Upstream	Downstream
	
Note	
n/a	

WC 2

Description

Watercourse width	1.5 m
Watercourse depth	0.3 m
Channel width	2 m
Substrate	Sandy gravel
Instream Vegetation	Yes
Gradient	Moderate



Upstream






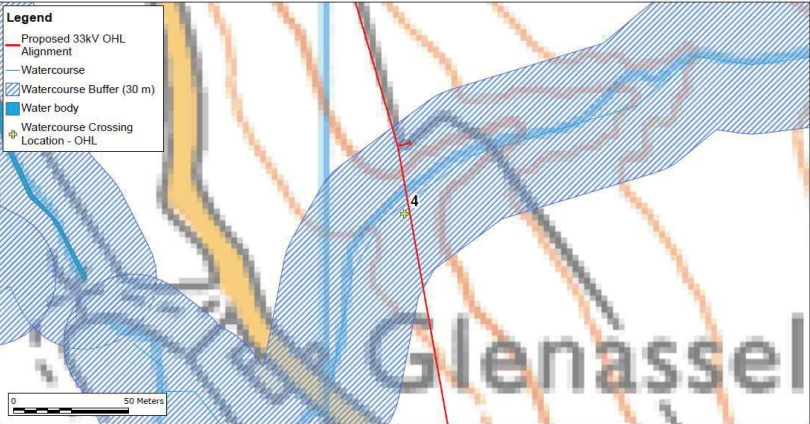


Downstream









Note



n/a

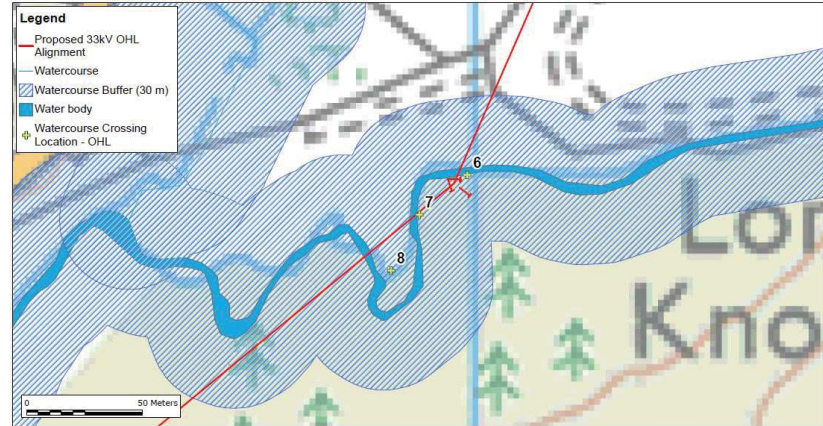
WC 3		
Description		
Watercourse width	1 m	
Watercourse depth	0.1 m	
Channel width	1 m	
Substrate	Sandy gravel	
Instream Vegetation	No	
Gradient	Gentle	
Upstream		Downstream
		
Note		
n/a		

WC 4	
Description	
Watercourse width	1 m
Watercourse depth	0.1 m
Channel width	2 m
Substrate	Sandy gravel
Instream Vegetation	Yes
Gradient	Steep
	
Upstream	Downstream
	
Note	
n/a	

WC 5		
Description		
Watercourse width	0.5 m	
Watercourse depth	0.1 m	
Channel width	1 m	
Substrate	Sandy gravel	
Instream Vegetation	Yes	
Gradient	Steep	
Upstream		Downstream
		
Note		
n/a		

WC 6	
Description	
Watercourse width	3 m
Watercourse depth	0.4 m
Channel width	4 m
Substrate	Sandy gravel
Instream Vegetation	No
Gradient	Gentle
	
Upstream	Downstream
	
Note	
n/a	

WC 7	
Description	
Watercourse width	3 m
Watercourse depth	0.4 m
Channel width	4 m
Substrate	Sandy gravel
Instream Vegetation	No
Gradient	Gentle
Upstream	Downstream
	
Note	
n/a	



WC 8

Description

Watercourse width	3 m
Watercourse depth	0.4 m
Channel width	4 m
Substrate	Sandy gravel
Instream Vegetation	No
Gradient	Gentle



Upstream

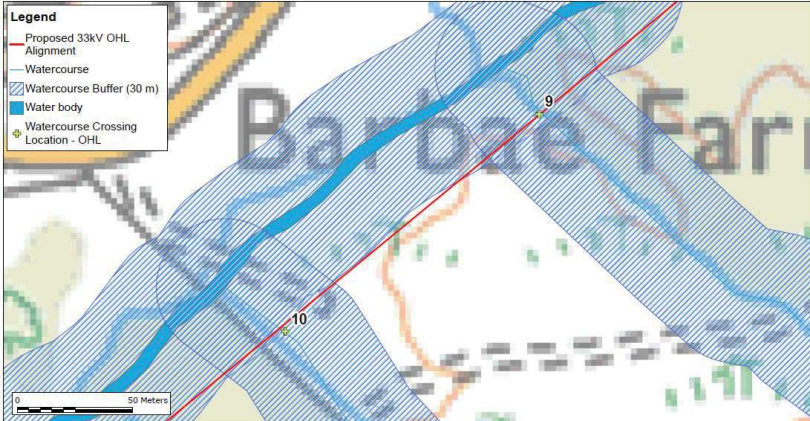




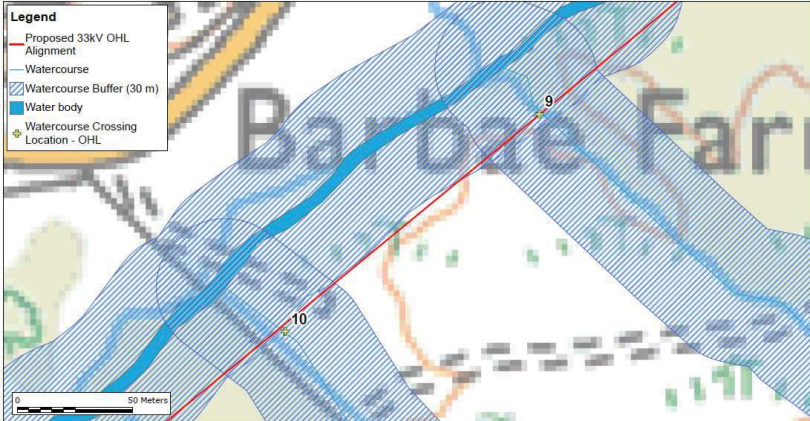


Downstream

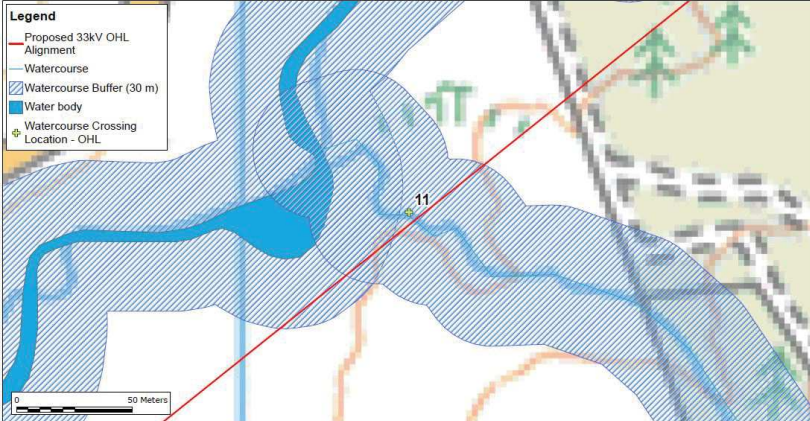




Note

n/a

WC 9	
Description	
Watercourse width	1.5 m
Watercourse depth	0.1 m
Channel width	2 m
Substrate	Sandy gravel
Instream Vegetation	Yes
Gradient	Steep
	
Upstream	Downstream
	
Note	
n/a	

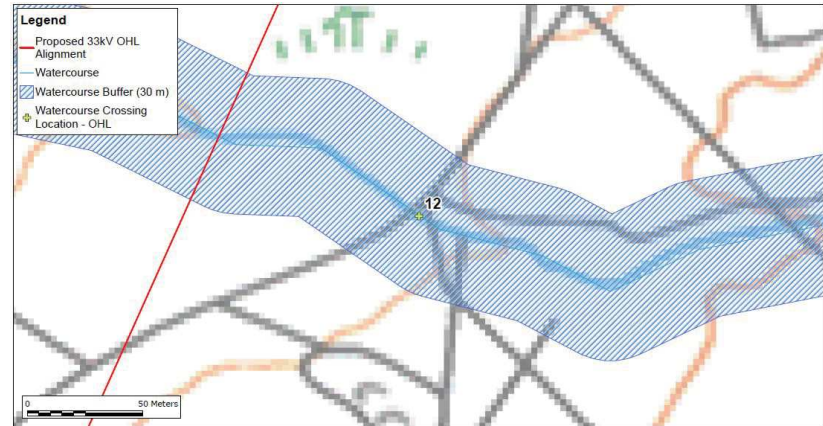
WC 10	
Description	
Watercourse width	0.5 m
Watercourse depth	0.1 m
Channel width	1 m
Substrate	Sandy gravel
Instream Vegetation	Yes
Gradient	Moderate
	
Upstream	Downstream
	
Note	
n/a	

WC 11	
Description	
Watercourse width	2 m
Watercourse depth	0.3 m
Channel width	4 m
Substrate	Sandy gravel
Instream Vegetation	No
Gradient	Steep
	
Upstream	Downstream
	
Note	
n/a	

WC 12

Description

Watercourse width	1 m
Watercourse depth	0.3 m
Channel width	1.5 m
Substrate	Mud/ Gravel
Instream Vegetation	No
Gradient	Moderate



Upstream



Downstream



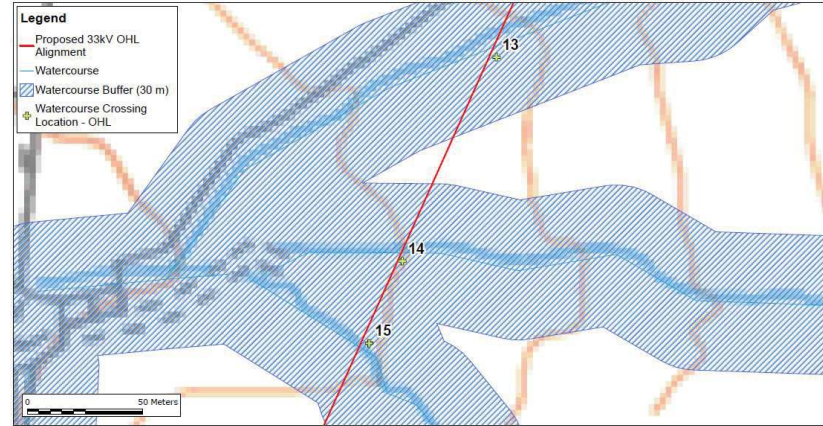
Note

Photo taken from beyond fence, around 50 m from identified crossing.

WC 13

Description

Watercourse width	1 m
Watercourse depth	0.1 m
Channel width	5 m
Substrate	Gravel
Instream Vegetation	No
Gradient	Steep



Upstream	Downstream	Gradient

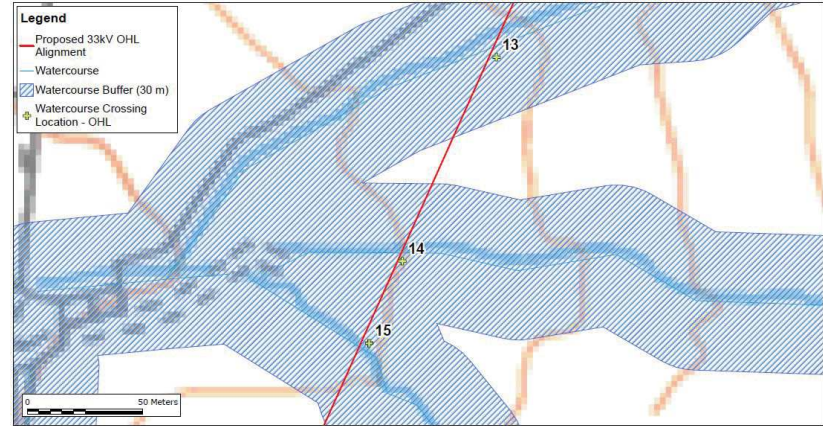
Note

n/a

WC 14

Description

Watercourse width	1 m
Watercourse depth	0.1 m
Channel width	2 m
Substrate	Mud
Instream Vegetation	Yes
Gradient	Moderate



Upstream



Downstream



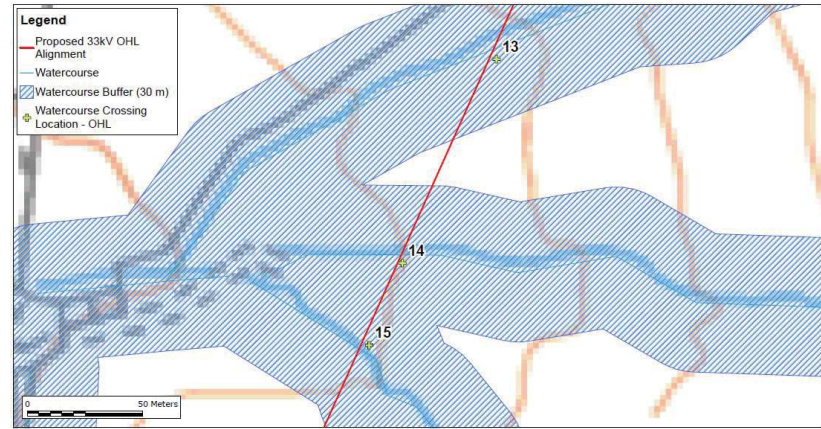
Note

n/a

WC 15

Description

Watercourse width	1.5 m
Watercourse depth	0.1 m
Channel width	4 m
Substrate	Gravel and mud
Instream Vegetation	No
Gradient	Steep



Upstream

Downstream

Gradient



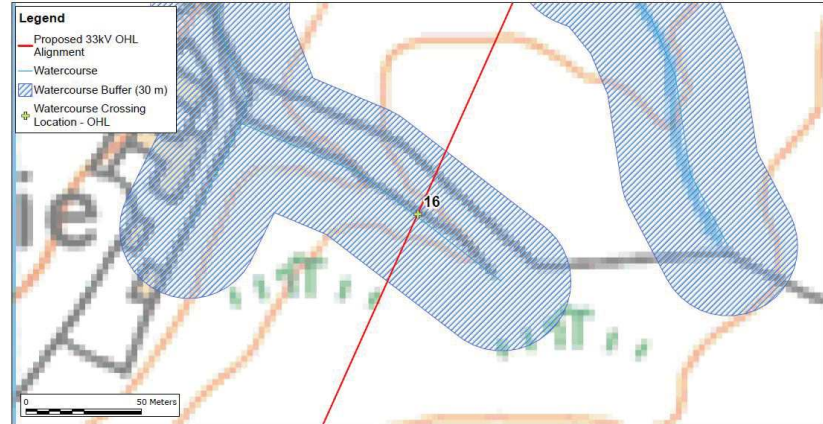
Note

n/a

WC 16

Description

Watercourse width	0.5 m
Watercourse depth	0.1 m
Channel width	2 m
Substrate	Gravel and mud
Instream Vegetation	No
Gradient	Moderate



Upstream



Downstream



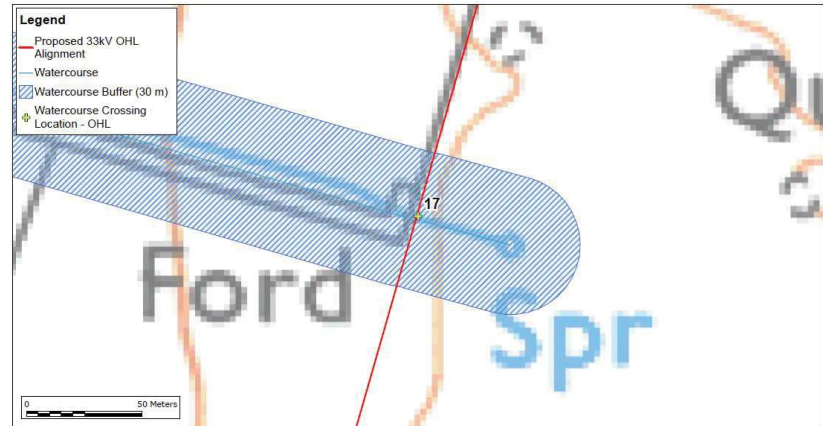
Note

n/a

WC 17

Description

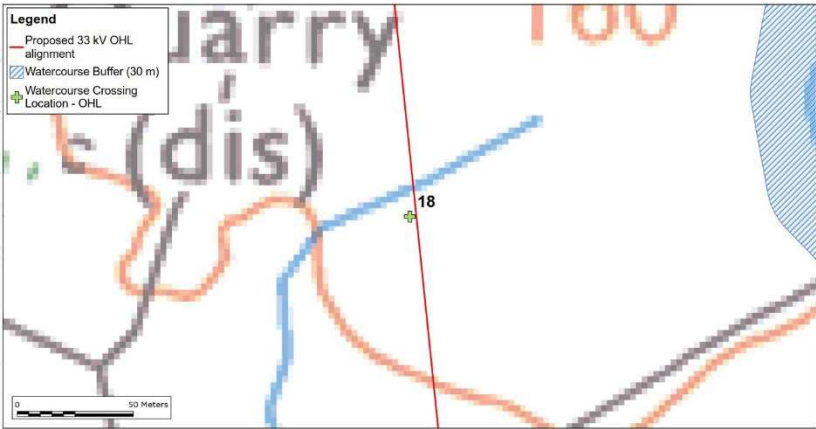


Watercourse width	1.5 m
Watercourse depth	0.05 m
Channel width	1.5 m
Substrate	Mud
Instream Vegetation	Yes
Gradient	Gentle



Upstream	Downstream	Spring near WC 15
		

Note

Near spring, underground pipe near identified crossing.

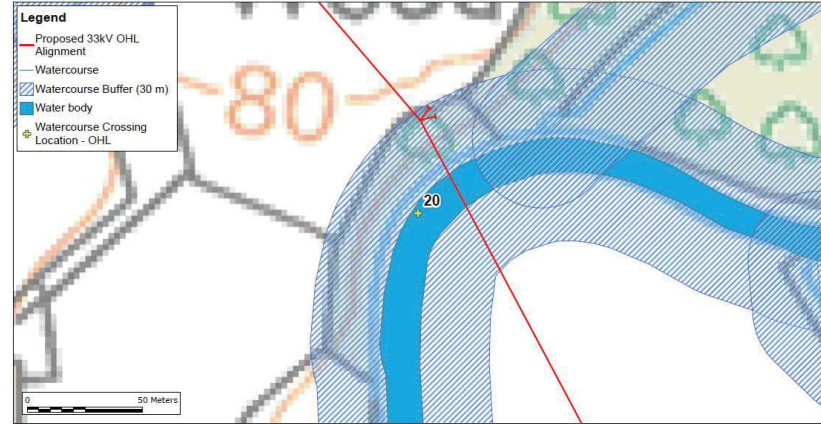
WC 18		
Description		
Watercourse width	0.5 m	
Watercourse depth	0.05 m	
Channel width	0.5 m	
Substrate	Mud	
Instream Vegetation	Yes	
Gradient	Gentle	
Upstream		Downstream
		
Note		
Water not flowing on the day of visit.		

WC 19		
Description		
Watercourse width	0.3 m	
Watercourse depth	See note	
Channel width	0.3 m	
Substrate	See note	
Instream Vegetation	Yes	
Gradient	Moderate	
Upstream		Downstream
Note		
Cannot see water depth and water bed due to vegetation cover.		

WC 20

Description

Watercourse width	7 m
Watercourse depth	0.4 m
Channel width	8 m
Substrate	Gravel
Instream Vegetation	No
Gradient	Steep



Upstream	Downstream	Gradient

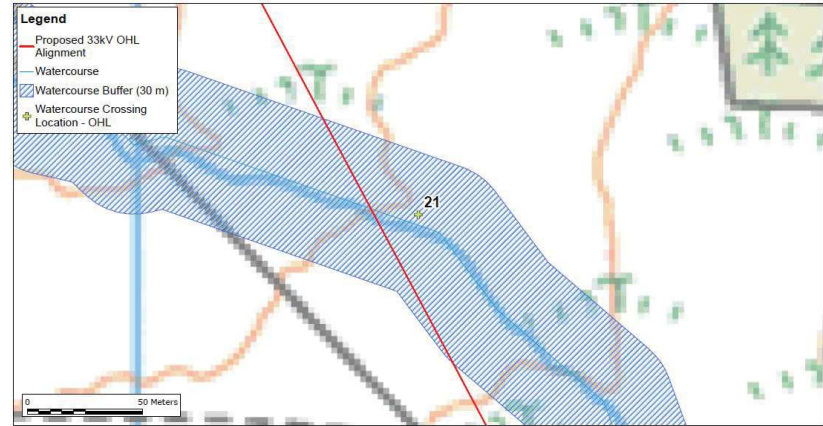
Note

n/a

WC 21

Description

Watercourse width	1 m
Watercourse depth	0.2 m
Channel width	2 m
Substrate	Cannot identify
Instream Vegetation	Yes
Gradient	Gentle



Upstream



Downstream



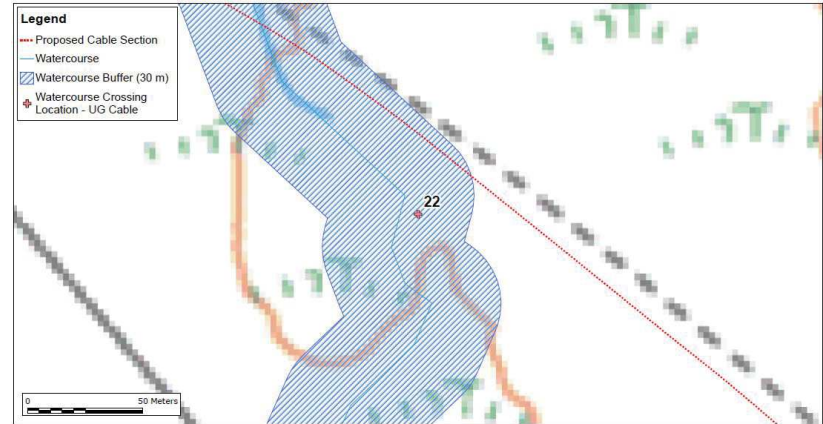
Note

n/a

WC 22

Description

Watercourse width	1 m
Watercourse depth	0.05 m
Channel width	1 m
Substrate	Mud
Instream Vegetation	Yes
Gradient	Gentle



Upstream

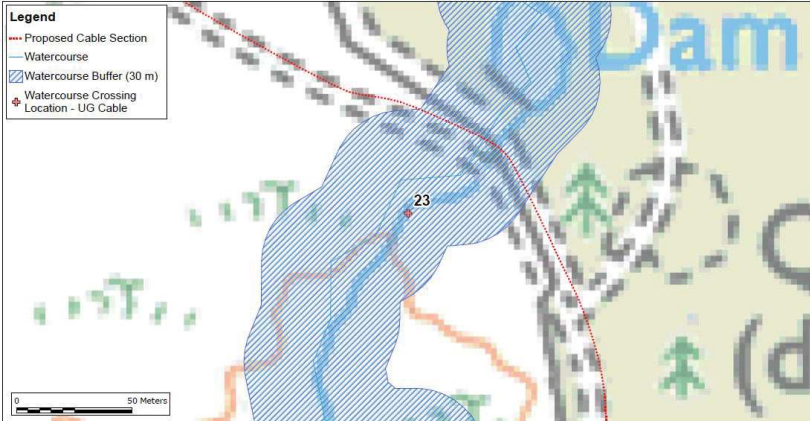




Downstream



Note

n/a

WC 23		
Description		
Watercourse width	1 m	
Watercourse depth	0.2 m	
Channel width	1 m	
Substrate	Gravel	
Instream Vegetation	Yes	
Gradient	Moderate	
Upstream		Downstream
		
Note		
n/a		

WC 24

Description

Watercourse width	0.5 m
Watercourse depth	0.1 m
Channel width	1 m
Substrate	Mud
Instream Vegetation	Yes
Gradient	Gentle



Upstream



Downstream



Note




Looks like boggy area and drain from pond.

WC 25

Description

Watercourse width	3 m*
Watercourse depth	0.3 m
Channel width	5 m*
Substrate	Mud
Instream Vegetation	Yes
Gradient	Gentle



Crossing Point	Upstream	Downstream
		

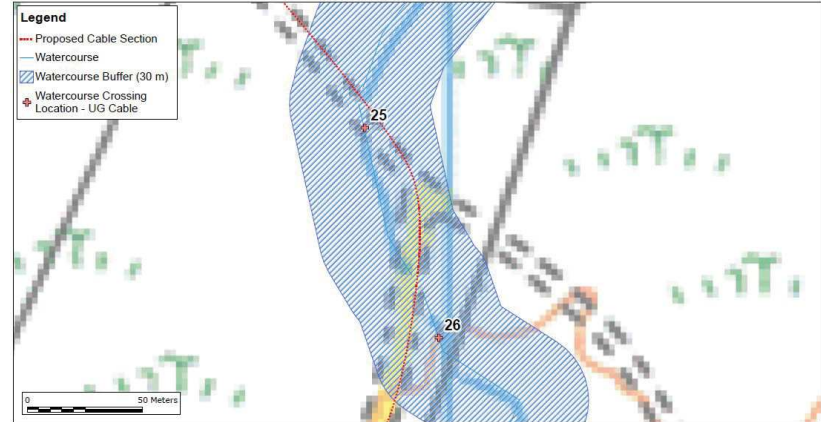
Note

*No obvious channel, measurements and assessment done on visible standing water.

WC 26

Description

Watercourse width	1.5 m
Watercourse depth	0.2 m
Channel width	3 m
Substrate	Mud
Instream Vegetation	Yes
Gradient	Gentle



Crossing Point	Upstream	Downstream
		

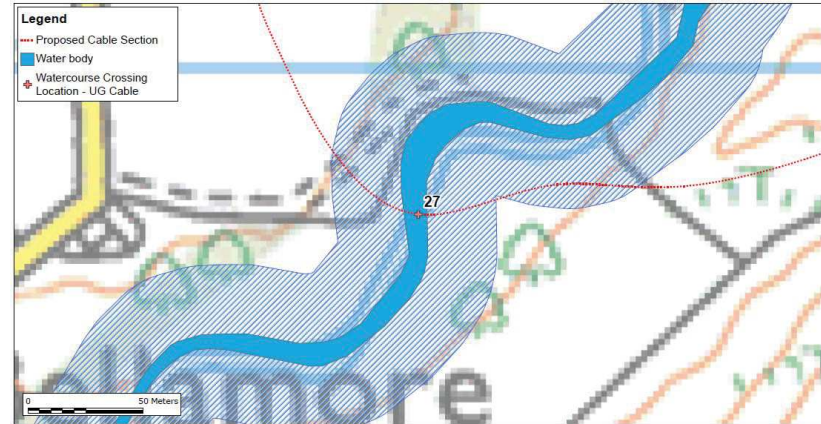
Note

n/a

WC 27

Description

Watercourse width	4 m
Watercourse depth	0.2 m
Channel width	8 m
Substrate	Gravel
Instream Vegetation	No
Gradient	Steep



Upstream



Downstream



Note

Existing bridge upstream.

TECHNICAL APPENDIX 8.2: GROUNDWATER ABSTRACTION AND GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEM (GWDTE) APPRAISAL

1.1 Introduction

This appendix provides a summary of the Private Water Supplies (PWS) and the Groundwater Dependent Terrestrial Ecosystem (GWDTE) habitats within the context of the proposed development. It provides a description of the bedrock and superficial geology, and the appraisal takes into account the results of the extended Phase 1 habitat survey conducted by Ramboll (Chapter 7). A further hydrogeological appraisal of the identified PWSs and the potential GWDTEs is then described.

The appraisal has been undertaken in accordance with guidance available from the Scottish Environment Protection Agency (SEPA), including:

- LUPS Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems¹.

SEPA guidance requires an assessment of groundwater abstractions and GWDTE within:

- 100 m radius of all excavations less than 1 m in depth; and
- 250 m radius of all excavation greater than 1 m in depth.

The physical characteristics of the proposed development and the proposed construction methods will result in excavations greater than 1 m in depth for each wood pole location. In addition, excavations of greater than 1 m would be required for the installation of underground cable. The appraisal is supported by maps to illustrate the location of the proposed infrastructure, with PWS and GWDTE overlain, showing the specified buffer zones of 100 m and 250 m (see Figure 8.2.5a-c).

Appendix 2 of the guidance (Checklist for Submitted Information: Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems) has been completed and is appended to this appraisal in Annex 8.2.1.

1.2 Baseline Conditions

1.2.1 Bedrock Geology

The British Geological Society (BGS) 625K bedrock geology data², indicates that the following bedrock formations underlie the proposed development:

- Leadhills Supergroup - Wacke. Sedimentary Bedrock formed approximately 444 to 467 million years ago in the Ordovician Period.
- Tappins Group - Wacke. Sedimentary Bedrock formed approximately 451 to 467 million years ago in the Ordovician Period.
- Kirkcolm Formation - Wacke. Sedimentary Bedrock formed approximately 451 to 461 million years ago in the Ordovician Period.

Figure 8.2.1 illustrates the bedrock geology.

1.2.2 Superficial Geology

In terms of superficial deposits, the proposed development is predominantly underlain by till (diamiction), which usually comprises sandy, silty clay with pebbles, but can contain gravel-rich,

¹ Scottish Environment Protection Agency, Land Use Planning System SEPA Guidance Note 31, Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems

² <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

or laminated sand layers. Figure 8.2.2 illustrates the distribution of the recorded superficial deposits, highlighting that for some sections of the proposed development, no superficial deposits are recorded.

1.2.3 Hydrogeology

The 625K hydrogeological data available from the British Geological Society (BGS)³, indicates that all of the bedrock formations mentioned in section 1.2.1 comprise low productivity aquifers with small amounts of groundwater in near surface weathered zones and fractures (Figure 8.2.3).

Due to the assumed low hydraulic conductivity of the superficial deposits described in section 1.2.2, all of them may be classed as low productivity aquifers, where a water table / saturated zone is present. Groundwater maybe present, perched above low permeability horizons or above bedrock with potentially limited vertical and horizontal connectivity.

1.2.4 Private Water Supplies

Due to the nature of the proposed development (limited excavations, <3 m depth), it is considered that only PWS within 250 m of the proposed development would have potential to be affected by changes in the hydrological/ hydrogeological regime. Therefore, a study area of 250 m on either side of the OHL and underground cable was defined for this risk assessment. The proposed development includes construction of one stretch of temporary access track between Muck Water and Mark Hill Substation, and this was also considered within the 250 m study area. This study area equates to the radius within which SEPA guidance requires all groundwater abstractions to be identified (250 m). No additional allowance has been made for any excavation works within a greater distance of the proposed development.

PWS data were requested from South Ayrshire Council and were provided on the 21st July 2017⁴. Four PWS were identified within the 250 m study area (Figure 8.2.4a-b).

Further hydrological and hydro-geological desktop study information has been used to help qualitatively determine the potential sensitivity of each PWS. This has included consideration of topography, distance between the proposed development and the PWS, and the excavation required. Further detail with regard to each of these four PWS is provided in Table 8.2.1 below.

Table 8.2.1 Private Water Supplies within 250 m of OHL/Cable					
ID	Easting	Northing	Address	Source Type	Use
PWS 1	221051	592532	Daldowie	Unknown	Domestic (< 50 Persons)
PWS 2	221309	591796	Maclachrieston	Spring	Domestic (< 50 Persons)
PWS 3	221321	590764	Kilpatrick	Spring (rising in field above the farm)	Domestic (< 50 Persons)
PWS 4	223285	586928	Bellamore	Spring (rising in field above the property)	Domestic (< 50 Persons)

³ <http://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSHydroMap>

⁴ Email from Elaine Little, South Ayrshire Council Environmental Health Department, to Amanda Chan, Ramboll

1.2.5 Groundwater Dependant Terrestrial Ecosystems (GWDTE)

Introduction

Excavation of soil and bedrock during the construction phase of the proposed development may cause localised disruption and interruption to groundwater flow. Interruption of groundwater flow would potentially reduce the supply of groundwater to GWDTEs thereby causing an alteration/change in the quality or quantity of and/or the physical or biological characteristics of the GWDTE. Contamination of groundwater may also cause physical or chemical contamination of the GWDTE.

Following identification of potential GWDTEs from Phase 1 mapping data, the hydrological and hydrogeological desktop study information has been used to help qualitatively determine the potential sensitivity of each potential GWDTE.

Further details with regard to each GWDTE identified are provided below. The sensitivity of each of the GWDTE receptors has been classed based upon classifications provided within SEPA's guidance LUPS4¹.

Phase 1 Habitat Survey

The NBN habitats dictionary⁵ was used to compare the habitat classifications of the Phase 1 habitats recorded on the site and the NVC. Species present within each habitat were then used to identify potential GWDTEs. The SEPA classification is modified from the UKTAG (2004) and UKTAG (2009) list of NVC communities^{6,7}, which provides the full list for all communities; therefore, the relevant UKTAG classification is also provided. Table 8.2.2 sets out the Phase 1 habitats present on site with their corresponding NVC communities and confirms which are considered to have the potential to be a GWDTE; and which have therefore been assessed further within this report. Locations of GWDTE habitats are shown on Figures 8.2.5a-c.

Phase 1 Code	NVC Code	NVC Community Name	Groundwater Dependency (SEPA)	Groundwater Dependency (UKTAG/Scotland)
B5	M23	<i>Juncus effusus/acetiflorus- Galium palustre</i> rush-pasture	High	Moderate
B5	M6	<i>Carex echinata - sphagnum recurvum</i> mire	High	High

Further ecological information, regarding the potentially sensitive communities identified on site is provided below.

Note that the 'study area' refers to the area surveyed by Ramboll in July 2016 and 2017, as described within Chapter 7.

⁵ http://habitats.nbn.org.uk/about_project.htm

⁶ UK TECHNICAL ADVISORY GROUP ON THE WATER FRAMEWORK DIRECTIVE, Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems, January 2004 [available at: http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Risk%20assessment%20of%20terrestrial%20ecosystems%20groundwater_Draft_210104.pdf].

⁷ UK TECHNICAL ADVISORY GROUP ON THE WATER FRAMEWORK DIRECTIVE, Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems, Annex 1, NVC plant communities and dependency on groundwater (table updated 5 October 2009) [Available at: <http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/UKTAG%20guidance%205%20ab%20ANNEX%201%20updated%205%20October%202009.pdf>]

M23 Juncus effusus/acutiflorus- Galium palustre rush-pasture

This habitat type occurs primarily to the south of the B734 and the Water of Assel, west of the trig point on hill summit 236m, with smaller areas near Tralodden Bridge and High Troweir and a small area to the north of Muck Water. It is dominated by soft rush *Juncus effusus*, sharp-flowered rush *J. acutiflorus*, creeping soft-grass *Holcus mollis*, Yorkshire fog *H. lanatus*, tufted hair-grass *Deschampsia cespitosa*, yellow iris *Iris pseudacorus* and meadowsweet *Filipendula ulmaria*. This habitat tended to occur in low-lying areas close to watercourses, suggesting there may be some dependency on surface water.

M6 Carex echinata – sphagnum recurvum mire

This habitat type occurs around Muck Water and on the approach to the Mark Hill substation. It is dominated by soft rush, sharp-flowered rush, flat-topped bogmoss *Sphagnum fallax* and common haircap moss *Polytrichum commune*. The areas around Muck Water suggest this habitat has some dependency on surface water sources but the two areas on the approach to the Mark Hill substation on Garleffin Hill do not occur around watercourses, suggesting a dependency on groundwater sources.

These potential GWDETs are shown on Figures 8.2.5a-8.2.5c.

Table 8.2.3 lists the NVC Communities present within the study area and their groundwater dependency, according to the site-specific, ecological conditions encountered during the site visit.

Table 8.2.3: NVC Communities present within the study area and their Groundwater Dependency, according to the site-specific, ecological conditions		
NVC code	NVC Title	Groundwater Dependency (Ecological assessment)
M23	<i>Juncus effusus/acutiflorus- Galium palustre</i> rush-pasture	Moderate
M6	<i>Carex echinata – sphagnum recurvum</i> mire	Moderate*
* = With the exception of areas where the potential GWDETs were not apparently associated with surface water or with the peatbog system; these are considered to have high groundwater dependency.		

1.3 Private Water Supply Risk Assessment

PWS 1

PWS 1 (Figure 8.2.4a) is located downgradient of the proposed development, at approximately 105 m AOD, and lies approximately 110 m west of the overhead line section of the proposed development (approximately 135 m AOD, at its highest location within the 250 m buffer).

However, due to the limited area of excavation and limited amount of time that would be required for installation of the wood poles, and the distance between the PWS and the proposed development, potential impacts on this PWS are considered unlikely. However, the mitigation measures listed in section 1.6 below should be observed.

PWS 2

PWS 2 (Figure 8.2.4a) is located upgradient of the proposed development, at approximately 160 m AOD, and lies approximately 55 m east of the overhead line section of the proposed development (approximately 165 m AOD, at its highest location within the 250 m buffer).

Due to the limited area of excavation and limited amount of time that would be required for installation of the wood poles, and particularly due to the location of the PWS (upgradient of the proposed development), potential impacts on this PWS are considered unlikely.

PWS 3

PWS 3 (Figure 8.2.4b) is located downgradient of the proposed development, at approximately 70 m AOD, and lies approximately 230 m west of the overhead line section of the proposed development (approximately 90 m AOD, at its highest location within the 250 m buffer).

Due to the limited area of excavation and limited amount of time that would be required for installation of the wood poles, and the distance between the PWS spring and the proposed development, potential impacts on this PWS are considered unlikely. However, the mitigation measures listed in section 1.6 below should be observed.

PWS 4

PWS 4 (Figure 8.2.4b) is located downgradient of the proposed development, at approximately 110 m AOD, and lies approximately 183 m south west of the underground cable section of the proposed development (approximately 120 m AOD, at its highest location within the 250 m buffer).

Due to the distance between the PWS spring and the proposed development and the limited area of excavation that would be required for installation of the underground cable, potential impacts on this PWS are considered unlikely. However, the mitigation measures listed in section 1.6 below should be observed.

1.4 Hydrogeological Assessment

This section presents a summary of the groundwater dependency assessment of potential GWDTE's identified in Figures 8.2.5a-8.2.5c and the residual effects resulting from the mitigation of the potential impacts likely to arise from all phases of the proposed development.

1.4.1 Summary of Potential Impacts

A description of the proposed development is provided in Chapter 3. Each wood pole support structure and the underground cable would require excavations greater than 1 m in depth.

Typically, each pole would require an excavation of approximately 3 m² and 2 m depth. Each pole is placed in the excavation, and the void is backfilled with the excavated material. As such, each wood pole has a small footprint following construction.

The underground cable section would be excavated to a typical depth of between 0.9 and 1.6 m, and 0.6 m in width. The cables may be laid in cement bound sand, followed by backfilling with the excavated material.

No access tracks would form part of the OHL section of the proposed development; access to the pole locations would be obtained either by foot or by using track mats and low ground pressure vehicles, in order to prevent potential effects on the habitats identified within the study area.

Temporary access tracks will be required for the underground cable section of the proposed development. These tracks would be temporary stone tracks approximately 3 m in width.

Figure 8.2.4a-b indicates that one PWS is located within 100 m of an excavation location for wood poles, while a further two PWS are located within 250 m of an excavation location for wood poles. In addition, one OWS is location within 250 m of an excavation location for underground cable.

Figure 8.2.5 a- c indicates that there are four GWDTE habitat areas within 250 m of an excavation location for wood poles. Six wood poles are located within GWDTE areas. In addition, the underground cable is within 250 m of six GWDTE areas and would cross four GWDTE areas. Note that there is one GWDTE area that is within 250 m of both wood poles and underground cable.

Taking account of the physical characteristics of the proposed development, there is limited potential for temporary impacts on groundwater during the construction stage. During operation the proposed development would have a small footprint, with each excavation having been backfilled using the excavated materials. As such, there is unlikely to be any significant change in groundwater flow as a result of the proposed development.

1.4.2 Groundwater Dependency

UKTAG guidance (2004) recognises that most “water dependent terrestrial ecosystems lie along a continuum between always only groundwater dependent and always only surface water dependent. The source of water supply for some wetlands does not appear to be critical, therefore the task of identifying dependence upon groundwater is sometimes complex”.

The SNIFFER (2007) guidance⁸ states that the dependence of wetlands on groundwater bodies is a result of the hydrological connectivity. The degree of dependency will vary depending upon whether the wetland is underlain by a low productivity or high productivity aquifer and whether there is a hydrological linkage mechanism between groundwater and the surface wetland.

Likelihood of dependency is based upon the following:

- High Likelihood: Characterised by intergranular, high productivity drift aquifer and dominantly intergranular, highly productive aquifer;
- Moderate Likelihood: Characterised by intergranular, moderate productivity drift aquifer and fractured, very low productivity aquifer; and
- Low Likelihood: Characterised by intergranular, low productivity drift aquifer and fractured, very low productivity aquifer.

As mentioned above, the site is underlain by bedrock aquifers with low productivity where the flow is virtually all through fractures and other discontinuities. Where drift deposits are present within the site, these would also be of low productivity. Therefore, it is assumed that there is **low likelihood** of groundwater dependency for all the GWDTEs within the site.

The UKTAG (2004) guidance provides criteria for identification and inclusion of GWDTEs in the risk assessment process, based on the complementary ecological and hydrogeological assessments. These criteria have been used to produce the matrix shown in Table 8.2.4, which provides an identification of the sensitive and potentially sensitive GWDTEs that will require a qualitative assessment to ascertain the significance of risks posed by the proposed development⁹.

⁸ Scotland & Northern Ireland Forum for Environmental Research (2007) Wetland Hydrogeomorphic Classification for Scotland [available at: http://www.envirobase.info/PDF/SNIFFER_WFD66_Final_Report.pdf]

⁹ Helen Culshaw and Andrew Halcro-Johnston, Golder Associates (UK) Ltd, “An integrated hydro-ecological approach to the identification of sensitive groundwater dependent terrestrial ecosystems within wind farm Environmental Impact Assessment” [Available at: https://www.geolsoc.org.uk/~media/shared/documents/specialist%20and%20regional%20groups/Hydro/GDE/Posters/Poster4_GDE_Meeting_Feb13.pdf?la=en]

Table 8.2.4: Matrix for Identification of Sensitive GWDTEs from Ecological and Hydrogeological Assessments			
Ecological Assessment of NVC Communities	Hydrogeological Assessment Groundwater Dependency Level		
	High Likelihood	Moderate Likelihood	Low Likelihood
Highly groundwater dependent	Sensitive GWDTE	Potentially sensitive GWDTE	Potentially sensitive GWDTE
Moderately groundwater dependent	Potentially sensitive GWDTE	Potentially sensitive GWDTE	Not sensitive
Not groundwater dependent	Potentially sensitive GWDTE	Not sensitive	Not sensitive

Given the limited potential for impact (based on the physical characteristics of the proposed development) and the low likelihood of groundwater dependency, based on the hydrogeological assessment, all the areas identified in the ecological assessment of NVC communities as potentially Moderately GWDTEs were considered not sensitive and have therefore been excluded from further assessment. A number of potentially sensitive GWDTEs were identified as outlined in Table 8.2.5, below.

Table 8.2.5: Potentially sensitive GWDTEs			
NVC code	NVC Title	GW Dependency (Ecological Assessment)	GWDTE
M6	<i>Carex echinata - Sphagnum recurvum</i> mire	Moderate*	Not sensitive*
M23	<i>Juncus effusus/acutiflorus - Galium palustre</i> rush-pasture	Moderate	Not sensitive
* = With the exception of areas where the potential GWDTEs were not apparently associated with surface water or with the peatbog system; these are considered to have high groundwater dependency.			

All of the habitats identified by the NVC data and mapping as potentially Moderately GWDTEs are assessed as not sensitive, on the basis of the characteristics of the underlying geology and associated hydrogeology.

However, some of the areas identified as potentially highly GWDTEs by the ecological assessment of NVC communities, are considered to be potentially sensitive GWDTEs. This applies to two small areas of M6 habitat not apparently associated with surface water or with the peatbog system, as noted in Table 8.2.4. These potentially sensitive GWDTEs are shown on Figure 8.2.5, and, are located in proximity to the proposed location of underground cabling.

1.5 Mitigation Embedded in the Design

A number of mitigation measures have been incorporated into the routeing and standard construction practices for the proposed development, as follows:

- Avoid, where possible, areas identified as potentially sensitive GWDTEs via micro-siting of the proposed development;

- Where complete avoidance is not feasible, limit impacts by siting infrastructure down hydraulic gradient or only near the edges of the GWDTE. The use of a clay/bentonite plug in the cable bed would be considered to avoid a change to the preferential pathway for groundwater flow;
- The design of any temporary access tracks should allow for continued hydrological connectivity;
- Minimise the working area by pegging out the final agreed route and fencing to ensure the footprint of the working area does not widen; and
- Ecological Clerk of Works to be present when micrositing near the two potentially sensitive GWDTE areas.

1.6 Mitigation During Construction

The following mitigation measures should be implemented during the construction phase, to minimise potential impacts on the three PWS identified in section 1.3 above:

- No refuelling or storage of equipment, materials, chemicals or standing machinery to occur within 250 m of the PWS;
- Initial inspection/ sampling prior to commencement of works, in order to establish existing water quality in the area;
- Water quality monitoring/sampling for the duration of construction activities in the vicinity of the PWS in order to ensure that any pollution incident is immediately identified and rectified;
- Emergency Response Procedures to be detailed within the Construction Phase Environmental Management Plan (EMP) and implemented in the event of spillage or incident during the construction period. The local residents should be notified immediately in the event of spillage or incident within 250 m of the PWS;
- Final closedown inspection/ sampling prior to leaving affected area; and
- Contractors will be required to integrate any mitigation measures developed from the PWS risk assessment, and industry best practice, into the EMP and site documentation to ensure the protection of PWSs in terms of quality and quantity of supply.

1.7 Further GWDTE Risk Assessment

Further risk assessment has been completed, in order to identify potential impacts that the proposed development may have on potential GWDTEs. Figure 8.2.5c shows the four areas of potential sensitive GWDTE which the proposed underground cable is passing through.

GWDTE 4

The proposed cable trench would pass through and be up-gradient of an area of NVC class M23 which comprises potentially sensitive GWDTE and covers a total area of approximately 106,192 m². It is predicted that the cable trench would occupy approximately 217.43 m², 0.2% of the habitat area. Therefore, the impact on the GWDTE is likely to be negligible.

GWDTE 7

The proposed cable trench would pass through an area of NVC class M23 which comprises potentially sensitive GWDTE and covers a total area of approximately 4,668 m². It is predicted that the cable trench would occupy approximately 18.22 m², 0.4% of the habitat area. Therefore, the impact on the GWDTE is likely to be negligible.

GWDTE 8

The proposed cable trench would pass through and be up-gradient of an area of NVC class M6 which comprises potentially sensitive GWDTE and covers a total area of approximately 5,863 m². It is predicted that the cable trench would occupy approximately 53.58 m², 0.91% of the habitat area. Therefore, the impact on the GWDTE is likely to be negligible.

GWDTE 9

The proposed cable trench would pass through and be up-gradient of an area of NVC class M6 which comprises potentially sensitive GWDTE and covers a total area of approximately 2,363 m². It is predicted that the cable trench would occupy approximately 14.1 m², 0.59% of the habitat area. Therefore, the impact on the GWDTE is likely to be negligible.

Annex 8.2.1

Checklist for Submitted Information – Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (GWDTE).

	Information Requirements	Confirm Provided	ES reference: Figure / Section
1	Plans showing all proposed infrastructure, including temporary works.	Yes	Figure 3.1: Proposed Development.
2	Plans overlain with details of the extent and depths of all proposed excavations.	Yes	Detail regarding extent and depth of excavations is detailed in Chapter 3: Proposed Development.
3	Plans show the relevant specified buffer zones (100 m and 250 m).	Yes	Figures 8.2.5a-c
4	Plans overlain with source of groundwater abstractions: <ul style="list-style-type: none"> All groundwater abstractions within 100m radius of all excavations shallower than 1m. All groundwater abstractions within 250m of all excavations deeper than 1m. Or statement provided to confirm none. 	Yes	Figure 8.2.4a-b
5	Plans overlain with GWDTE (Phase 1 habitat survey) data: <ul style="list-style-type: none"> Within 100 m radius of all excavations shallower than 1 m. Within 250 m of all excavations deeper than 1m. Or statement provided to confirm none. 	Yes	Figure 8.2.5
6	Applicant confirmation of one of following (as shown on above plans): <ul style="list-style-type: none"> No groundwater abstractions and GWDTE on site. Groundwater abstractions and/or GWDTE identified and 250 m buffer zones implemented. Confirmation that the groundwater abstraction owners have agreed 	Yes	Four groundwater abstractions are within 250 m of the proposed development; these are examined in Technical Appendix 8.3 Private Water Supply Assessment. Figure 8.2.5 shows potential GWDTE within 250 m of proposed pole locations.

	Information Requirements	Confirm Provided	ES reference: Figure / Section
	contingency plans including temporary or permanent replacement of a groundwater supply.		Figure 8.2.3 shows PWS abstractions within 250 m of proposed pole locations. No adverse impacts are anticipated in regard to PWS.
7	Applicant can confirm above plans show excavations or intrusions within 100 m buffer zone are shallower than 1m.	No	Excavations potentially greater than 1 m are proposed within 100 m of potential GWDTE areas.
8	Applicant can confirm above plans show excavations or intrusions are on/in a groundwater abstraction or GWDTE.	Yes	Applicant can confirm above plans show excavations or intrusions are located on potential GWDTEs Figure 8.2.5. However, these potential GWDTEs have been assessed as not potentially sensitive.
9	Applicant can confirm infrastructure involves excavations deeper than 1 m within 250 m of sensitive receptors or unable to comply with monitoring requirements.	Yes	Applicant can confirm infrastructure does involve excavations deeper than 1 m within 250 m of sensitive receptors, therefore a bespoke risk assessment is provided.
10	Bespoke risk assessment provided.	Yes	Technical Appendix 8.2 Groundwater Abstraction and Groundwater Dependent Terrestrial Ecosystem (GWDTE) Appraisal.
Signature: Ramboll		Organisation: On behalf of SP Energy Networks	

9. FORESTRY APPRAISAL

9.1 Introduction

This chapter identifies the likely impacts on forestry and woodland associated with the construction and operation of the proposed development, and, provides details of control measures where appropriate. The specific objectives of the chapter are to:

- Describe the baseline forestry environment;
- Identify the potential direct and indirect impacts on forestry receptors; and
- Describe any mitigation or control measures proposed to address likely impacts.

Figure 9.1 is referenced in the text where relevant.

Where issues identified within the forest and woodland areas require additional detail with regard to Ecology and Ornithology, these are provided within Chapter 7.

9.2 Methodology

This report has been produced using a combination of site visits and a desk study.

The desk study comprised review of the following data:

- GIS data indicating the location of the proposed development, including proposed pole locations; and
- aerial photography mapping available for the area.

The site visit was undertaken on 4th August 2017 and comprised the following:

- ground truthing of existing site information; and
- recording the main criteria of forestry blocks likely to be affected by the proposed development, including tree species, height and stocking.

9.3 Baseline Conditions

The proposed development runs north to south through areas of typical farming and forest landscape for south west Scotland.

The baseline conditions of the woodlands that would potentially be directly affected by the OHL and underground cable sections of the proposed development and associated 30 m, 12 m and 24m wayleave corridor are described in Table 9.1 below.

Aerial mapping of the proposed development and associated wayleave is shown on Figure 9.1.

Table 9.1: Baseline Conditions of Woodlands with Potential to be Directly Affected by the Proposed Development.			
Description of Woodland Areas within 30 m Corridor of the OHL			
Landowner	Location		Description
	Chainage	Wood pole	
Land parcel 1		148	0.04 ha of farmfield corridor broadleaves.
Land parcel 2		142	0.08 ha of burnside broadleaves.
Land parcel 3		129	0.05 ha of farmfield corridor broadleaves.
Land parcel 4		120-124	0.24 ha of roadside and farmfield corridor broadleaves.
Land parcel 5		108-111	0.01 ha of mature broadleaves. 0.16 ha of semi mature first crop 10-14 m tall conifer plantation (Sitka Spruce, Norway Spruce).

Table 9.1: Baseline Conditions of Woodlands with Potential to be Directly Affected by the Proposed Development.			
Land parcel 6		106-108	0.01 ha mature broadleaves woodland. 0.02 ha of conifer trees (Pine, Fir pockets). 0.10 ha of 4-6 m tall broadleaves (ash, hazel, birch, willow, aspen).
Land parcel 7		99-106	0.18 ha of 8-16 m broadleaves (ash, hawthorn, hazel, alder, cherry). 0.14 ha of semi mature first crop 14-16 m tall Sitka Spruce plantation. 0.08 ha of semi mature first crop 10-14 m tall Norway spruce plantation.
Land parcel 8		89	0.04 ha of burnside / infield corridor broadleaves.
		86	
Land parcel 9		63-64	0.17 ha of farmfields corridor broadleaves. Beech 18-20 m tall mainly. 6 m Ash trees.
		51-52	0.10 ha of river Stinchar burnside broadleaves. 20 m tall Beech mainly, some Oak, Ash, Rowan.
Land parcel 10		49-51	0.02 ha Individual broadleaf trees. Pole 49 tree 12 m away from the line centre.
		45	0.12 ha Hedge broadleaves 6 m high.
Description of Woodland Areas within 12 m Corridor of the Underground Cable			
Land parcel 11	1800-2100		0.37 ha of forest ground recently clear-felled and assumed replanted with conifer species.
	2100-2600		0.18 ha of mature Sitka Spruce stand.
Land parcel 12	3000-4000		0.42 ha of mature broadleaves.

9.4 Potential Impacts and Mitigation

The preferred route has been chosen to avoid areas of forest where possible and as a result has a relatively low impact on both commercial forest and broadleaf woodland. Mitigation options are limited and not deemed important to achieve, on the basis that the majority of woodland areas have been avoided by the initial routing.

9.4.1 Construction

Potential effects during construction are detailed in Table 9.2 below, which also details the relevant receptor and mitigation or control measures, where appropriate.

Table 9.2: Potential Impacts on Forestry during Construction and Relevant Mitigation/Control Measures		
Potential Impact	Receptor	Mitigation/Control Measures Proposed
Selective felling of approximately 1.48 ha of broadleaved woodlands and 0.58 ha of commercial conifer plantations. 0.37 ha of assumed conifers replanted ground.	Landowner, forest manager, forest users.	Prior to construction, a detailed assessment would be made of individual trees and forest blocks together with the risk of windblow towards the proposed development. Wood pole and cable trench locations would be micro sited to reduce the number of trees that would require to be felled.
Disturbance of access to the forest land	Landowner, forest manager, forestry	Access will be managed in correspondence with the landowner.

Potential Impact	Receptor	Mitigation/Control Measures Proposed
during tree felling and construction	workers, general land users.	
Sterilisation of land used for commercial forestry plantation and broadleaved trees.	Landowner	Compensation payment to landowner.
Permanent removal of 2.53 ha of woodland for the purposes of conversion to another type of land use.	Scottish Government's Policy on Control of Woodland Removal (2009).	0.42 ha of roadside broadleaves are suggested to be retained with the cable trench moved circa 20 m south- east away from trees. (Chainage 3000-4000). Planting of low growing broadleaves within the 30 m wayleave corridor associated with the proposed development to reduce the size of the impact.
Removal of 1.6 ha of assumed 40 m wide corridor of mature Sitka Spruce trees (Chainage 2100 – 2600) to provide safe working conditions. (Risk of windblow of Sitka Spruce estimated 22 m tall).	Construction team.	Compensation agreement with landowner.
Tree removal by felling which has a potentially adverse impact on breeding birds or Bat roosts.	Associated Wildlife	Prior to tree felling all woodland areas will be surveyed shortly before the proposed felling date when any risk to either breeding birds or Bat roosts will be full assessed and appropriate measures taken to avoid this.

9.4.2 Operation

Potential effects during operation are detailed in Table 9.3 below, which also details the relevant receptor and mitigation or control measures, where appropriate.

Potential Impact	Receptor	Mitigation/Control Measures Proposed
Windblow to exposed brown edge of woodland blocks.	Landowner, forest manager.	Prior to construction, trees will be felled to existing green edges using forest rides and watercourse boundaries. In addition, tree crown reduction would be considered in relation to selective remaining edge trees. Following construction, fast growing shrubs may be planted on existing edges to establish the forest edge. Chainage 2100-2600 of the underground cable will affect windblow stability of the remaining 19.04 ha mature conifer crops. The removal and replanting of the whole block is suggested in communication with the landowner/ forest manager.
Greater difficulty in harvesting with the	Forest manager, workers. Landowner.	Felling of wider than 30 m wayleave corridor to avoid difficult harvesting conditions in the future should be considered.

Table 9.3: Potential Impacts on forestry during Operation and Relevant Mitigation/Control Measures

<p>presence of a live overhead powerline or underground cable in vicinity of working machinery.</p>		
<p>Greater difficulty in timber stacking and timber haulage with risk of electrification from the proposed development.</p>	<p>Forest manager, workers, landowner.</p>	<p>Higher wood poles positioned adjacent to the powerline crossing with the haulage road (instead of the crossing located in the OHL mid-span) will increase the vertical clearance for road traffic.</p> <p>Underground cable section to have clear markings to the roadside to prevent stacking timber produce on top of the live electrical cable.</p> <p>Ducted forest access points designed and created in communication with the landowner/ forest manager.</p>

10. SUMMARY AND SCHEDULE OF MITIGATION

10.1 Summary

This Environmental Appraisal has been prepared to:

- describe the proposed development;
- identify the potential direct and indirect impacts of the proposed development on the environment; and
- describe the mitigation or control measures proposed to address likely impacts.

The proposed development comprises a new overhead line and underground cable connection to connect the consented Tralorg Wind Farm with the national grid at Mark Hill substation. The alignment of the proposed development was identified through an iterative process supported by desk-based analysis, ground conditions and field surveys, engineering studies and landowner-related assessments. The proposed overhead line runs from the consented Tralorg wind farm substation southwards to the end of an existing track off the B734 at Pinmore Mains. The connection would be completed by underground cable from this point to the Mark Hill substation, crossing Muck Water between Bellamore and Garleffin.

Environmental appraisals of the proposed development have been undertaken considering: landscape and visual amenity, cultural heritage, ecology (including ornithology), hydrology and hydrogeology, and forestry. The appraisals identify the potential for some temporary disturbance during the construction phase. This temporary disturbance can be largely controlled through good construction management and, where necessary, micro-siting the OHL and cable alignment to avoid direct impacts to ecological or cultural heritage assets.

10.2 Schedule of Mitigation

The potential impacts and mitigation measures have been compiled into a "Schedule of Mitigation" which is presented in Table 10.1 below.

Mitigation measures which are 'by design', in other words, which have been incorporated into the final design as reflected on the application drawings provided for the proposed development, are not included here as they form part of the proposed development, as described in Chapter 3: Proposed Development.

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
Landscape and Visual	Landscape fabric	Site clearance; excavation of the ground for access track construction, pole base construction; undergrounding of the cable section; placement of temporary construction compound; reinstatement works.	<ul style="list-style-type: none"> • The proposed development will follow the alignment of existing tracks and forestry roads as far as practicable. The creation of new tracks or markings across the landscape fabric will be minimised. • Reinstatement of the ground condition following construction activities in areas of temporary access, the construction compound and the cable section, where existing vegetation will be replaced on the excavated trench. • The temporary stone track associated with the construction of the underground cable will be removed upon completion of construction and any damage to the landscape fabric will be restored to a condition in keeping with adjacent ground conditions. • Excavated material will be stored appropriately and will be used for back filling and dressing of disturbed areas. • Where possible, laydown areas will be located in areas that are already disturbed or cleared of vegetation. • Laydown areas, the temporary construction compound and all other temporary facilities will be removed, and the landscape restored immediately following completion of the construction works. • All working areas would be restricted as far as practicable to the specified areas and demarcated to prevent incursion of site plant onto non-construction areas. • Material storage/ stockpiles would be retained for the shortest duration practicable and would be sited to avoid visual intrusion to neighbouring receptor locations. • Public access along roads and paths will be retained throughout the construction period. 	Construction

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
			<ul style="list-style-type: none"> Night lighting of construction sites/ compounds will be minimised within the requirements of health and safety, and only in use at locations where activity is being carried out. 	
Landscape and Visual	Landscape character and Visual amenity / visual receptors	Loss of mature vegetation within the proposed development site, and consequent construction of the poles.	<ul style="list-style-type: none"> Tree felling will be limited to only those necessary for the safe construction and operation of the grid connection. 	Construction
Landscape and Visual	Landscape character and Visual amenity / visual receptors	Presence of construction activity (including movement) and construction equipment such as excavators, tractors and scaffold tunnels.	<ul style="list-style-type: none"> All construction equipment will be removed, and the landscape restored immediately following completion of the construction works. Night lighting of construction sites/ compounds will be minimised within the requirements of health and safety, and only in use at locations where activity is being carried out. Material storage/ stockpiles would be retained for the shortest duration practicable and would be sited to avoid visual intrusion to neighbouring receptor locations. Where possible, laydown areas will be located in areas that are already disturbed or cleared of vegetation. 	Construction
Landscape and Visual	Landscape character and Visual amenity / visual receptors	Presence of new wood pole line (including conductor) within the landscape; presence of cleared wayleave.	<ul style="list-style-type: none"> The height of the poles would typically be 11 m above the adjoining ground level (including steel work and insulators). Pole heights may be increased locally (up to a maximum height of 18 m) where required to safely cross features such as watercourses and access tracks, such as those at Tormitchell Quarry. Where possible, the proposed alignment has been routed to reduce its impact on the character of the landscape, and its prominence in views from the wider area. 	Operation

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
Landscape and Visual	Landscape character and Visual amenity / visual receptors	Disturbance, movement and activity associated with maintenance activities.	<ul style="list-style-type: none"> Where maintenance activities are required, they will be programmed to ensure that they are undertaken in a timely and localised manner. All maintenance equipment will be removed, and any disturbed ground reinstated (if applicable) immediately following completion of the maintenance works. 	Operation
Cultural Heritage	Asset 16: Field system and rig and furrow cultivation remains Asset 19(a): Field bank Asset 20: Field system Asset 26: Field system Asset 28: Field bank Asset 29: Field bank Asset 36(b): Field bank Asset 37: Field bank Asset 38: Field bank Asset 40: Field bank / Head dyke Asset 44: Ordnance Survey benchmark Asset 54: Enclosure; Field Asset 55: Field bank	Assets within the LoD corridor for the proposed development where construction works for the proposed development could disturb the asset.	<ul style="list-style-type: none"> Detailed mitigation measures will be set out in a Written Scheme of Investigation (WSI) in response to any archaeological planning condition included on the consent. The WSI be developed through consultation with WoSAS, acting on behalf of the Council, and will be implemented ahead of commencement of the construction works. Where possible microsite the proposed development to avoid direct impacts on identified assets. Mark-off assets during construction works, to ensure preservation in situ. Assets that cannot be avoided should be investigated and recorded prior to / during construction works. Archaeological investigations would be carried out to a specification and standard to be agreed in writing with South Ayrshire Council through consultation with WoSAS. 	Construction
Cultural Heritage	Asset 1: Trackway Asset 20: Field system Asset 26: Field system Asset 28: Field bank	Access routes for use during construction causing a direct impact on cultural heritage assets.	<ul style="list-style-type: none"> Detailed mitigation measures will be set out in a Written Scheme of Investigation (WSI) in response to any archaeological planning condition. The WSI be developed through consultation with WoSAS, acting on behalf of the 	Construction

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
	Asset 29: Field bank Asset 36(a): Field bank Asset 36(b): Field bank Asset 38: Field bank Asset 40: Field bank / Head dyke Asset 44: Ordnance Survey benchmark Asset 54: Enclosure; Field Asset 55: Field bank		Council, and will be implemented ahead of commencement of the construction works. <ul style="list-style-type: none"> • Where possible microsite the proposed development to avoid direct impacts on asset. • Where linear assets (such as banks and walls) survive as upstanding features, access tracks would be routed through any existing gates or broken (less well preserved) sections where possible. • Mark-off asset during construction works, to ensure preservation in situ. • Assets that cannot be avoided should be investigated and recorded prior to / during construction works. • Archaeological investigations would be carried out to a specification and standard to be agreed in writing with South Ayrshire Council through consultation with WoSAS. 	
Cultural Heritage	Unknown	Direct impact on unknown cultural heritage features within areas of forestry plantation (which were not covered by the field survey).	<ul style="list-style-type: none"> • No mitigation necessary. The area was surveyed in advance of the planting of the forestry in 1993 (Carter & Dalland 1993). 	Construction
Cultural Heritage	Unknown. Low potential for presently unknown buried archaeological remains to survive within areas of ground disturbance associated with the proposed development.	Direct impact on buried archaeological remains.	<ul style="list-style-type: none"> • Any requirement for archaeological monitoring works/watching briefs during the construction phase would be agreed in consultation with West of Scotland Archaeology Service (WoSAS) advisors to South Ayrshire Council. • Detailed mitigation measures will be set out in a Written Scheme of Investigation (WSI) in response to any archaeological planning condition and will be implemented ahead of commencement of the construction works. • If significant discoveries are made during archaeological monitoring and preservation in situ is not possible, provision would be made for an appropriate amount of investigation 	Construction

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
			and recording to be agreed in writing with South Ayrshire Council through consultation with WoSAS. That provision would include the consequent production of written reports on the findings, with post-excavation analyses and publication of the results of the work where appropriate.	
Ecology and Ornithology	Habitats (woodland, marshy grassland and hedgerows. Blanket bog and wet modified bog are considered below. GWDTE are considered in Appendix 8.2: GWDTE Appraisal).	Vegetation clearance, tree felling, access track construction, permanent excavation of pole bases, excavation and undergrounding of cable section and placement of temporary construction compound.	<ul style="list-style-type: none"> • Immediate reinstatement of habitats following construction activities in areas of temporary access, particularly access tracks, the construction compound and the cable section, where existing vegetation would be replaced on the excavated trench, where possible. Temporary access tracks are proposed between Muck Water and Mark Hill substation and would be 3 m wide and of a floating stone construction, running adjacent to the underground cable route to minimise the impacts on habitats. The track would be removed following energisation of the connection, or before, and the ground reinstated. Other areas of the proposed development would be accessed using low ground-pressure vehicles without the construction of access tracks. • Avoidance of areas of marshy grassland, where possible. If not possible, floating access tracks/bog mats and low ground-pressure vehicles would be used to cross these habitats. Locating woodpoles within these habitats would be avoided as far as possible, with only three woodpoles locations proposed in marshy grassland. • Avoidance of removal of hedgerow habitat, as shown on Figures 7.3a and 7.3f. • Avoidance of tree felling, where possible, particularly in areas classified as ancient woodland or included on the semi-natural woodland inventory. This is in line with the Scottish Government's Policy on Control of Woodland Removal¹, as 	Construction

¹ Forestry Commission (2009) The Scottish Government's Policy on Control of Woodland Removal, Forestry Commission Scotland

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
			referenced by the Scottish Planning Policy ² , which includes a presumption against any woodland removal. Minimal tree felling is considered to be required for the proposed development and is discussed in more detail in Chapter 9: Forestry. The proposed development does not cross any areas of ancient woodland but three woodpole locations are proposed in areas included on the semi-natural woodland inventory.	
Ecology and Ornithology	Blanket bog and wet modified bog	Disturbance/loss of Annex 1 habitats from access track construction, permanent excavation of pole bases and excavation and undergrounding of cable section.	<ul style="list-style-type: none"> Avoidance of blanket bog and wet modified bog, where possible. If not possible, floating access tracks/bog mats and low ground-pressure vehicles would be used to cross these habitats. Peat probing results would be used to inform the micro-siting of woodpole locations to avoid areas of deep peat. However, if this is not possible, suitable restoration would be undertaken and a Peatland Habitat Management Plan would be produced. Engagement with SEPA would occur in regard to any excavated peat reuse and disposal, where required. However, it is not anticipated that there would be a need for peat disposal as all excavated material would be backfilled. 	Construction
Ecology and Ornithology	Bats and red squirrel	Felling of mature trees or trees with bat roost potential.	<ul style="list-style-type: none"> If tree felling is necessary, mature trees or areas noted as containing trees with bat roost potential would be surveyed by a licensed bat surveyor to ensure no bats are roosting in the trees. At the same time, trees to be felled would be checked for the presence of squirrel dreys. If bats are found to be roosting in the trees, felling would only occur under an SNH licence with a licensed bat surveyor present. Similarly, if a red squirrel drey is found to be present, felling could only occur under an SNH licence. 	Construction

National Office, Silvan House, 231 Corstorphine Road, Edinburgh, EH12 7AT

² The Scottish Government (2014) Scottish Planning Policy, The Scottish Government, St Andrew's House, Edinburgh, EH1 3DG.

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
Ecology and Ornithology	Otter, badger, water vole and reptiles	Disturbance from lights, noise and excavations.	<ul style="list-style-type: none"> Undertake pre-construction surveys for otter, badger and water vole no greater than eight months prior to construction. If the results indicate the presence of any of these species, an assessment of the impacts of the development on the species would be completed and appropriate mitigation measures identified (if required), such as micro-siting of woodpoles and access tracks. Environmental Management Plan (EMP) to include measures to protect ecological features, which would involve covering excavations and providing ramps in excavations to allow any trapped species to escape. These measures would be implemented at the end of each work day. A suitably qualified Ecological Clerk of Works (ECoW) would input into the EMP to ensure appropriate mitigation measures are in place, and to reduce any disturbance impacts. 	Construction
Ecology and Ornithology	Breeding birds	Destruction of bird nests.	<ul style="list-style-type: none"> Avoidance of sand martin colony located on the western bank of the Water of Assel. Ground or vegetation clearance works would be undertaken outwith the main bird nesting season (March–August inclusive), if possible. If this is not possible, a suitably experienced ecologist would check the proposed development prior to construction to determine if nesting birds are present, particularly the sand martin colony on the western bank of the Water of Assel. If nesting birds are found, a suitable buffer zone would be implemented around the nest, with no work in this zone until the young have fledged or the nest is no longer in use. 	Construction
Ecology and Ornithology	Galloway and South Ayrshire Biosphere	Pollution e.g. oil spill or siltation of watercourses.	<ul style="list-style-type: none"> Good practice guidance^{3,4} would be followed when working close to watercourses and ponds. 	Construction

3 https://www.sepa.org.uk/media/150997/wat_sg_29.pdf accessed 28th July 2017

4 <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/> accessed 28th July 2017

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
	Reserve (River Stinchar), Muck Water, four ponds and other watercourses as described in Chapter 8: Hydrology		<ul style="list-style-type: none"> The OHL construction would not require the construction of any new watercourse crossings, other than for the River Stinchar but this would not require any in-channel works. Access would use existing tracks and watercourse crossings as far as possible. Bog mats would be used to cross minor watercourses without damage to bank integrity. Where pole installation is required within 30 m of a watercourse, silt traps or other mitigation would be put in place (which would be outlined in the EMP), with nearby watercourses checked during periods of high rainfall during construction activities. Ground excavation work would temporarily stop work during periods of high rainfall, where a risk to surface water quality is identified. In order to cross the Muck Water, an open-cut with a flume crossing would be used. Consultation with the Ayrshire Rivers Trust has been undertaken and it has been agreed that the underground cable would be installed May to September, inclusive, to avoid the salmon spawning season. A fish rescue would be organised with the Ayrshire Rivers Trust and undertaken prior to construction. Measures to prevent pollution and/or siltation of watercourses, ponds and other habitats during construction would be included in the EMP. 	
Ecology and Ornithology	Habitats	Spread of invasive plant species	<ul style="list-style-type: none"> Although no invasive species were recorded during surveys, they are known to be present in the area. Any areas of invasive plant species discovered prior to (such as during pre-construction protected species surveys) or during construction would be separated from any construction by a minimum buffer of 10 m to avoid the spread of the invasive species. No invasive plant species or soil material potentially contaminated with seeds/roots would be disturbed or removed from the area. 	Construction

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
Ecology and Ornithology	Bats, red squirrel, otter, badger, water vole, reptiles and breeding birds	Disturbance due to maintenance activities.	<ul style="list-style-type: none"> Unlikely to be required as disturbance would be at a very low level and would utilise existing access tracks/roads. If any vegetation clearance is required, breeding bird and protected species surveys would occur prior to this, where appropriate. 	Operation
Ecology and Ornithology	Habitats	Pollution e.g. oil spill from vehicles accessing proposed development for maintenance activities.	<ul style="list-style-type: none"> Oil spill kits carried in vehicles, particularly when working in sensitive habitats such as blanket bog, marshy grassland and close to watercourses or ponds. 	Operation
Ecology and Ornithology	Raptor species	Collision with OHL.	<ul style="list-style-type: none"> Buzzard, peregrine, osprey and sparrowhawk are not considered to be highly vulnerable to collision risk⁵. SNH guidance for power lines advises against the use of mathematical collision risk models and instead suggests the use of mitigation to reduce potential collision impacts where flight activity levels are high enough to cause potential conflicts⁶. The flight activity levels observed within the site are low and it is considered that the potential for impacts is similarly low. In addition, the proposed development would consist of a wood pole line with the configuration of wires arranged in one horizontal plane, therefore presenting only a very narrow band within which a collision would be possible. The three wires are arranged in a narrow configuration so that the collision zone for birds not approaching the line in horizontal flight is similarly narrow. The likelihood of a collision is therefore deemed to be very low and is not considered to require mitigation or control measures. 	Operation

⁵ Urquhart, B. (2010) SNH Avoidance Rate Information & Guidance Note: Use of Avoidance Rates in the SNH Wind Farm Collision Risk Model. SNH.

⁶ SNH (2016) Assessment and Mitigation of Impacts of Power Lines and Guyed Meteorological Masts on Birds, Version 1.

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
Hydrology, Geology and Hydrogeology	Soils and peatland	Compaction and soil erosion along the route, including temporary construction compounds.	<ul style="list-style-type: none"> No access tracks would form part of the OHL section of the proposed development; access to the pole locations would be obtained either by foot or by using track mats and low ground pressure vehicles, in order to prevent potential effects on the habitats identified within the study area. Temporary access tracks will be required for the underground cable section of the proposed development. These tracks would be temporary stone tracks approximately 3 m in width. Best practice measures to control compaction and soil erosion caused by temporary access during construction would be set out in the Environmental Management Plan (EMP). 	Construction
Hydrology, Geology and Hydrogeology	Watercourses	Siltation or pollution of watercourses during excavation and as poles are put in place.	<ul style="list-style-type: none"> No engineering works are anticipated within any of the watercourses identified for wood pole installation. Therefore, works will not result in any alterations to the beds and banks of the watercourses and low pressure tracked excavators would be used for wood pole construction. 	Construction
Hydrology, Geology and Hydrogeology	Watercourses	Spills from temporary construction compounds causing pollution of watercourses.	<ul style="list-style-type: none"> Where pole installation is required within 30 m of a watercourse, good practice silt management – which would be outlined in the EMP – would be put in place, with nearby watercourses checked during periods of high rainfall during construction activities. Ground excavation work would temporarily stop work during periods of high rainfall. 	Construction
Hydrology, Geology and Hydrogeology	Watercourses	Watercourse crossings leading to siltation or pollution if good practice not followed.	<ul style="list-style-type: none"> All underground cable watercourse crossings would require authorisation under The Water Environmental (Controlled Activities) (Scotland) Regulations 2011 (CAR). Open-cutting with flume crossing would generally be used on all underground cable or temporary stone track watercourse crossings. Damming and over-pumping may be required depending on water flow at the time of the crossing. Construction techniques would be outlined in the EMP and 	Construction

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
			proposed crossing techniques / methods would be discussed and agreed with SEPA through CAR authorisation.	
Hydrology, Geology and Hydrogeology	Groundwater flow	Modification of groundwater flows by location of wood poles and/or by excavation of cable trench, forming a preferential flow path for sub-surface flows. In addition, any excavations below the groundwater level along the length of the cable route could lead to a localised groundwater drawdown.	<ul style="list-style-type: none"> The wood pole installation and cabling process would ensure that the trench design incorporates drainage design measures to ensure the discharge would not result in pollution to surface water; this would be set out in the EMP. Water within the trench would be pumped to a suitable settlement pond, prior to either infiltration or discharge. All underground cable watercourse crossings would require authorisation under <i>The Water Environmental (Controlled Activities) (Scotland) Regulations 2011 (CAR)</i>. 	Construction
Hydrology, Geology and Hydrogeology	Soils and peatland	Contamination from materials/wastes handled or stored at the temporary construction compounds.	<ul style="list-style-type: none"> All excavated material would be carefully stored a minimum of 30 m away from any watercourse, with particular care taken to preserve the integrity of soil structure and prevent any risk of runoff or sediment blow-off into watercourses. Temporary construction compounds will be kept to the minimum necessary for safe implementation of the works. On-site storage of oil and fuels will be avoided if possible but where on-site storage is required, the volumes to be stored would be minimised and stored in accordance with all applicable legislation and good practice. 	Construction
Hydrology, Geology and Hydrogeology	Private water supplies	Pollution of private water supplies during excavation and installation of wood poles and underground cabling.	<ul style="list-style-type: none"> No refuelling or storage of equipment, materials, chemicals or standing machinery to occur within 250 m of the PWS. Initial inspection/ sampling prior to commencement of works, in order to establish existing water quality in the area. Water quality monitoring/sampling for the duration of construction activities in the vicinity of the PWS in order to ensure that any pollution incident is immediately identified and rectified. 	Construction

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
			<ul style="list-style-type: none"> Emergency Response Procedures to be detailed within the EMP and implemented in the event of spillage or incident during the construction period. The local residents should be notified immediately in the event of spillage or incident within 250 m of the PWS. Final closedown inspection/ sampling prior to leaving affected area. Contractors will be required to integrate any mitigation measures developed from the PWS risk assessment, and industry best practice, into the EMP and site documentation to ensure the protection of PWSs in terms of quality and quantity of supply. 	
Hydrology, Geology and Hydrogeology	Groundwater	Interception of groundwater / interflow by the underground cable trench.	<ul style="list-style-type: none"> The design of the proposed development has avoided hydrologically sensitive areas where possible and has ensured appropriate buffer distances between construction elements and watercourses. This would minimise the risk of alterations to surface and groundwater flow patterns, water pollution and increased sediment loading during both construction and operational phases. 	Operation
Hydrology, Geology and Hydrogeology	Surface water, groundwater and soils.	Risk of minor leaks of fuel and hydraulic oil from maintenance vehicles.		Operation
Forestry	Landowner, forest manager, forest users.	Selective felling of approximately 1.48ha of broadleaved woodlands and 0.58 ha of commercial conifer plantations. 0.37 ha of assumed conifers replanted ground.	<ul style="list-style-type: none"> Prior to construction, a detailed assessment would be made of individual trees and forest blocks together with the risk of windblow towards the proposed development. Wood pole and cable trench locations would be micro sited to reduce the number of trees that would require to be felled. 	Construction
Forestry	Landowner, forest manager, forestry workers, general land users.	Disturbance of access to the forest land during tree felling and construction.	<ul style="list-style-type: none"> Access will be managed in correspondence with the landowner. 	Construction

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
Forestry	Landowner	Sterilisation of land used for commercial forestry plantation and broadleaved trees.	<ul style="list-style-type: none"> • Compensation payment to landowner. 	Construction
Forestry	Scottish Government's Policy on Control of Woodland Removal (2009)	Permanent removal of -2.53 ha of woodland for the purposes of conversion to another type of land use.	<ul style="list-style-type: none"> • 0.42 ha of roadside broadleaves are suggested to be retained with the cable trench moved circa 20 m south-east away from trees. (Chainage 3000-4000). • Planting of low growing broadleaves within the 30 m wayleave corridor associated with the proposed development to reduce the size of the impact. 	Construction
Forestry	Construction team	Removal of 1.6 ha of assumed 40 m wide corridor of mature Sitka Spruce trees (Chainage 2100 – 2600) to provide safe working conditions. (Risk of windblow of Sitka Spruce estimated 22 m tall).	<ul style="list-style-type: none"> • Compensation agreement with landowner. 	Construction
Forestry	Associated Wildlife	Tree removal by felling which has a potentially adverse impact on breeding birds or Bat roosts.	<ul style="list-style-type: none"> • Prior to tree felling all woodland areas will be surveyed shortly before the proposed felling date when any risk to either breeding birds or bat roosts will be full assessed and appropriate measures taken to avoid this. 	Construction
Forestry	Landowner, forest manager.	Windblow to exposed brown edge of woodland blocks.	<ul style="list-style-type: none"> • Prior to construction, trees will be felled to existing green edges using forest rides and watercourse boundaries. In addition, tree crown reduction would be considered in relation to selective remaining edge trees. • Following construction, fast growing shrubs may be planted on existing edges to establish the forest edge. • Chainage 2100-2600 of the underground cable will affect windblow stability of the remaining 19.04 ha mature conifer crops. The removal and replanting of the whole block is 	Operation

Table 10.1: Schedule of Mitigation				
Topic	Receptor	Potential Impact	Mitigation/Control Measures	Timing
			suggested in communication with the landowner/ forest manager.	
Forestry	Forest manager, workers. Landowner.	Greater difficulty in harvesting with the presence of a live overhead powerline in vicinity of working machinery.	<ul style="list-style-type: none"> Felling of wider than 30 m wayleave corridor to avoid difficult harvesting conditions in the future should be considered. 	Operation
Forestry	Forest manager, workers. landowner.	Greater difficulty in timber stacking and timber haulage with risk of electrification from the proposed development.	<ul style="list-style-type: none"> Higher wood poles positioned adjacent to the powerline crossing with the haulage road (instead of the crossing located in the OHL mid-span) will increase the vertical clearance for the road traffic. Underground cable section to have clear markings to the roadside to prevent stacking timber produce on top of the live electric cable. Ducted forest access points designed and created in communication with the landowner/ forest manager. 	Operation

