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Water Supply Project

Environmental Impact Assessment Report (EIAR)

Volume 6 of 6: Appendices

(Appendix 8.11) Vertigo Survey Report

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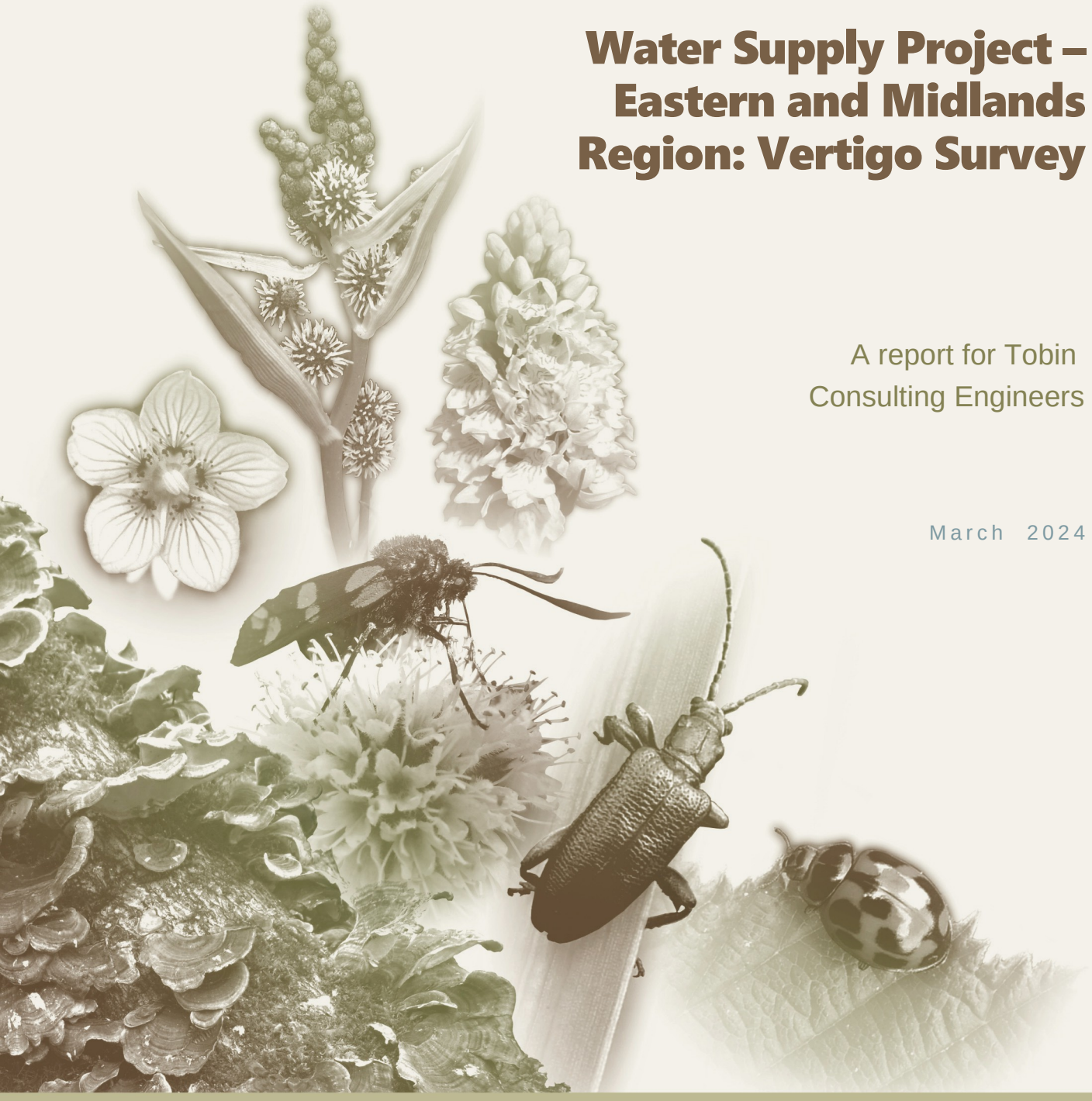
Water Supply Project – Eastern and Midlands Region: Vertigo Survey

A report for Tobin Consulting Engineers

March 2024



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Water Supply Project – Eastern and Midlands Region: *Vertigo* Survey

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1 Introduction

BEC Consultants Ltd was contracted by Tobin Consulting Engineers to carry out a survey for the presence of the Habitat's Directive Annex II-listed whorl snail whorl snail (*Vertigo* spp.) at six wetland sites along the route of the proposed water supply pipeline.

2 Background

2.1 Study Area

The study area for this survey comprised six wetland areas along the CPO land-take area for the proposed pipeline development: Derrycrib, Co. Kildare and Raheenduff, Annaghmore, Coolfin Glebe, Pass and Derrinclare, Co. Offaly (Figure 1).

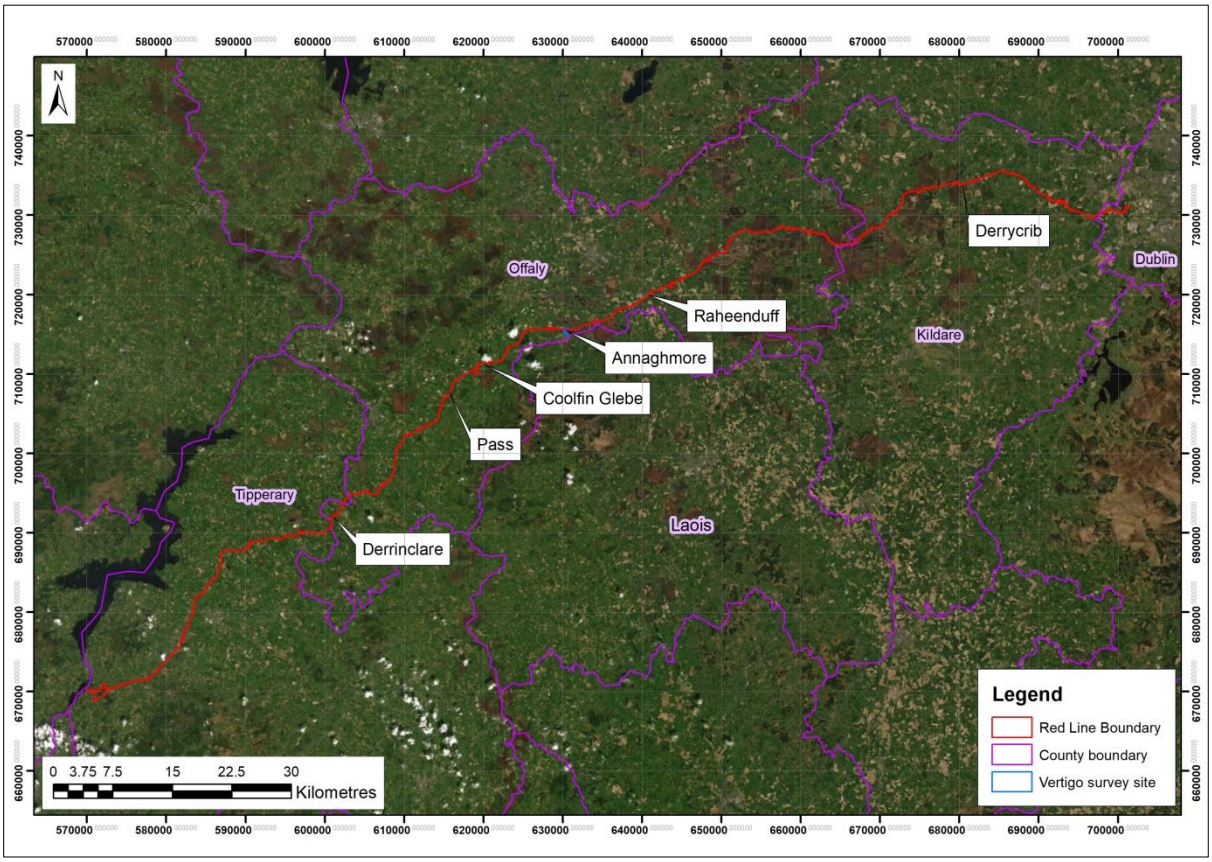

Figure 1. Map of the study area showing the locations of the six sites surveyed for *Vertigo* spp. Note: Red Line Boundary refers to the Project Boundary at time of survey.

3 Target *Vertigo* species

There are three *Vertigo* species listed under Annex II of the Habitats Directive: *Vertigo angustior* (Narrow-mounted whorl snail), *Vertigo geyeri* (Geyer's whorl snail) and *Vertigo moulinsiana* (Desmoulin's whorl snail). For species listed under Annex II, a member state must designate Special Areas of Conservation (SACs) for their protection and must report to the EU every six years on the species' conservation status.

3.1 *Vertigo angustior* (Narrow-mouthed whorl snail)

Vertigo angustior is a small snail (<2 mm tall), which can be found in a broad range of habitats including sand dunes, marshes, saltmarshes and fen, but has microhabitat requirements that are quite rare. In Ireland, it is most commonly found in sand dunes, within the damp *Festuca rubra* thatch of fixed dunes. It is also found in a narrow transition zone between wetland and terrestrial habitats with the right wetness levels and habitat structure. *Vertigo angustior* is listed under Annex II of the EU Habitats Directive (92/43/EEC) and is a Qualifying Interest in thirteen Special Areas of Conservation (SACs) across Ireland (Annex I, Table A1). The closest known SAC population of *V. angustior* to the study area is in the Rye Water Valley/Carton SAC (site code: 001398), Co. Kildare/Meath, which is approximately 5.6 km from the pipeline route.

The overall conservation status of *V. angustior* in Ireland from the last round of monitoring is Unfavourable-Inadequate with a deteriorating trend (NPWS, 2019). This is unchanged from the previous round of monitoring (NPWS, 2013). The conservation assessment for *V. angustior* is summarised in Table 1.

Table 1. Conservation assessment summary for *Vertigo angustior* in Ireland (NPWS, 2013; 2019).

Year	Range	Population	Habitat for species	Future prospects	Overall status
2007	Favourable	Inadequate	Inadequate	Inadequate	Inadequate
2013	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)
2019	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate	Inadequate (deteriorating)

3.2 *Vertigo geyeri* (Geyer's whorl snail)

Vertigo geyeri is a small snail (<2 mm tall) found in calcareous fens and flushes, at the base of small sedges and 'brown' mosses. It requires a stable hydrological regime that maintains a constantly saturated and open ground layer. Tufa formation is a good indicator for the presence *V. geyeri*. *Vertigo geyeri* is listed under Annex II of the EU Habitats Directive (92/43/EEC) and is a Qualifying Interest in fourteen Special Areas of Conservation (SACs) across Ireland (Annex I, Table A2). The closest known SAC population of *V. geyeri* to the study area is in the Lisduff Fen SAC (site code: 002147), Co. Offaly which is approximately 600 m from the pipeline route.

The overall conservation status of *V. geyeri* in Ireland from the last round of monitoring is Unfavourable-Bad with a deteriorating trend (NPWS, 2019). This is a decline from the previous round of monitoring (NPWS, 2013). The conservation assessment for *V. geyeri* is summarised in Table 2.

Table 2. Conservation assessment summary for *Vertigo geyeri* in Ireland (NPWS, 2013; 2019).

Year	Range	Population	Habitat for species	Future prospects	Overall status
2007	Favourable	Inadequate	Inadequate	Inadequate	Inadequate
2013	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (stable)	Inadequate (deteriorating)	Inadequate (deteriorating)
2019	Bad (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)	Bad	Bad (deteriorating)

3.3 *Vertigo moulinsiana* (Desmoulin's whorl snail)

Vertigo moulinsiana is a small snail (up to 2.7 mm tall) found on tall vegetation in calcareous wetland sites, including fens. It is listed under Annex II of the EU Habitats Directive (92/43/EEC) and is a Qualifying Interest in eight Special Areas of Conservation (SACs) across Ireland (Annex I, Table A3). The closest known SAC population of *V. moulinsiana* to the study area is in Ballynafagh Lake SAC (site code: 001387), Co. Kildare, which is approximately 4.6 km from the pipeline route.

The overall conservation status of *V. moulinsiana* in Ireland from the last round of monitoring is Unfavourable-Inadequate with a deteriorating trend (NPWS, 2019). This is unchanged from the previous round of monitoring (NPWS, 2013). The apparent improvement from 2007 to 2013 is due to the discovery of new sites, as opposed to the recovery of lost populations (NPWS, 2013). The conservation assessment for *V. moulinsiana* is summarised in Table 3.

Table 3. Conservation assessment summary for *Vertigo moulinsiana* in Ireland (NPWS, 2013; 2019).

Year	Range	Population	Habitat for species	Future prospects	Overall status
2007	Bad	Bad	Inadequate	Bad	Bad
2013	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)
2019	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate (deteriorating)	Inadequate	Inadequate (deteriorating)

4 Methods

The sampling methodology followed that used in the National *Vertigo* Monitoring Project (Long & Brophy, 2019; Moorkens & Killeen, 2011). An initial habitat suitability survey for all three species was carried out at each of the six wetland sites. An assessment of habitat suitability for supporting each of the target *Vertigo* species was made based on the vegetation present and the wetness levels at the time of survey, as well as the percentage area that could support the snail. The habitat suitability classes differ by species. The habitat suitability classes for *V. angustior* are presented in Table 4, *V. geyeri* in Table 5 and *V moulinsiana* in Table 6.

Table 4. Habitat suitability classes for *V. angustior* (extracted from Long & Brophy, 2019)

Habitat suitability class	Definition
1 Optimal	*V. angustio*r could survive in >50% of the habitat.
2 Optimal-Suboptimal	*V. angustior* could survive in 10-49% of the habitat.
3 Suboptimal	As used in Moorkens & Killeen (2011), *V. angustior* could survive in, on average, approximately 5% of the habitat. For the purposes of having an explicit definition, this definition was expanded to cover the range from 2% up to 9% of the habitat.
4 Suboptimal-Unsuitable	*V. angustior* could survive in only a very small section of the habitat (<2%). Moorkens & Killeen (2011) state that the habitat area should be "at least a number of metres square".
5 Unsuitable	There are no areas of suitable habitat i.e. the combination of vegetation and hydrological influence is outside the snail's typical range of tolerance.

Table 5. Habitat suitability classes for *V. geyeri* (extracted from Long & Brophy, 2019)

Habitat suitability class	Definition
1 Optimal	*V. geyeri* could survive in >50% of the habitat.
2 Optimal-Suboptimal	*V. geyeri* could survive in 3-49% of the habitat.
3 Suboptimal	This was defined by Moorkens & Killeen (2011) where *V. geyeri* could survive in, on average, approximately 2% of the habitat.
4 Suboptimal-Unsuitable	*V. geyeri* could survive in only a very small section of the habitat (<2%). Moorkens & Killeen (2011) state that the habitat area should be "at least a number of square metres".
5 Unsuitable	There are no areas of suitable habitat i.e. the combination of vegetation and hydrological influence is outside the snail's typical range of tolerance.

Table 6. Habitat suitability classes for *V. moulinsiana* (extracted from Long & Brophy, 2019)

Habitat class	Definition
Optimal	*V. moulinsiana* could survive in ≥50% of the habitat
Optimal-suboptimal	*V. moulinsiana* could survive in 16-49% of the habitat
Suboptimal	For this category Moorkens & Killeen (2011) state that *V. moulinsiana* could survive in, on average, 10% of the habitat. This definition was expanded to cover the range 5- 15%.
Suboptimal-Unsuitable	*V. moulinsiana* could survive only in a very small section of the habitat (<5%). Moorkens & Killeen (2011) state that the habitat area should be "at least a number of metres square".
Unsuitable	There are no areas of habitat where the combination of vegetation and hydrological influence is within the snail's known range of tolerance.

Where habitat was found that was deemed to have potential to support any of the three *Vertigo* species, samples were taken following the method appropriate to the species.

For *V. moulinsiana*, the most suitable vegetation found within the site was sampled by shaking it over a white tray. At each sample location, three adjacent patches of vegetation were sampled and these were treated as a single sample. Any whorl snails that were collected in the tray were transferred to labelled glass vials and returned to the laboratory for confirmation.

For *V. angustior* and *V. geyeri*, litter was collected from the appropriate habitat into three-litre muslin bags. These sample bags were labelled internally and returned to the laboratory to be dried. Once dried, the samples were sieved over nested sieves (0.5 mm and 1.0 mm) and a white tray, and each retained fraction searched for the target species.

A handheld computer and GPS (Nomad Trimble) running ArcPad 8.0 was used to navigate within the survey area and to record data in the field.

Vascular plant nomenclature follows Stace (2019), while bryophytes follow Atherton *et al*. (2010).

5 Results

5.1 Overview

A preliminary survey was carried out from 14-16 July 2020 to assess the habitat suitability of the flagged sites for supporting any of the three *Vertigo* spp. No habitat suitable to support any of the three target *Vertigo* species was found at Derrycrib, Annaghmore, Pass and Derrinclare. Raheenduff had potential to support *V. geyeri* and *V. moulinsiana*, while Coolfin Glebe had potential to support *V. moulinsiana*. None of the samples subsequently taken at these sites were positive for the presence of the target *Vertigo* species.

5.2 Derrycrib

The site at Derrycrib comprised a small depression in an area of cutover bog (Fossitt habitat code PB4) which has been converted to a horse pasture field at Derrycrib, Co. Kildare (Annex II, Figure A1). At the time of survey, the depression was dry with short vegetation including Creeping Bent (*Agrostis stolonifera*), Glaucous Sedge (*Carex flacca*), Common Sedge (*Carex nigra*), Ragwort (*Senecio jacobaea*), Cross-leaved Heath (*Erica tetralix*), Marsh Pennywort (*Hydrocotyle vulgaris*), Tormentil (*Potentilla erecta*), Silverweed (*Potentilla anserina*), Meadow Buttercup (*Ranunculus acris*), Creeping Buttercup (*Ranunculus repens*), Pointed Spear-moss (*Calliergonella cuspidata*) and Springy Turf-moss (*Rhytidiadelphus squarrosus*) (Annex III, Plate 1). The surrounding area supported similar vegetation and it is all on a peat substratum (Annex III, Plate 2). Across the road to the west of the site, there are the remains of a raised bog, with active cutting on-going.

This site had no habitat suitable for supporting any of the three target *Vertigo* species, due to the vegetation present and the dry, non-calcareous substratum.

5.3 Raheenduff

The site at Raheenduff comprised three areas wet grassland/wetland habitat at Raheenduff, Co. Offaly (Annex II, Figure A2). A stream runs in the south-north direction to the west of the surveyed areas. A fen area identified to the northwest of the surveyed area was not surveyed for *Vertigo* species, as it is hydrologically separated from the proposed pipeline route and so outside the zone of influence of the project.

The most northerly area comprised wet grassland (GS4) with Hard Rush (*Juncus inflexus*), Red Fescue (*Festuca rubra*), Yorkshire Fog (*Holcus lanatus*), Creeping Bent, Timothy (*Phleum pratense*), Hairy Sedge (*Carex hirta*), Red Clover (*Trifolium pratense*), Marsh Thistle (*Cirsium palustre*), Soft Rush (*Juncus effusus*) and Brambles (*Rubus fruticosus* agg.) (Annex III, Plate 3 & 4).

The middle area was divided between Purple Moor-grass (*Molinia caerulea*)-dominated wet grassland (GS4) and Black Bog-rush (*Schoenus nigricans*)-dominated rich fen and flush (PF1) (also, Annex I habitat 7230 Alkaline Fen). A small area within the *Schoenus*-fen was more flush-like with species including Long-stalked Yellow Sedge (*Carex viridula* ssp. *brachyrrhyncha*), Glaucous Sedge, Sharp-flowered Rush (*Juncus acutiflorus*), Devil's-bit Scabious (*Succisa pratensis*) and a moss layer including Pointed Spear-moss, Yellow Starry Feather-moss (*Campylium stellatum*) and Rusty Hook-moss (*Scorpidium revolvens*) (Annex III, Plate 5 & 6). The stonewort *Chara vulgaris* var. *longibracteata* was recorded from the wetter habitat of the flush.

The southernmost area was wet grassland (GS4), including Silverweed, Soft Rush, Hard rush, Meadowsweet (*Filipendula ulmaria*), Yorkshire Fog, Red fescue, Glaucous sedge, Ribwort Plantain (*Plantago lanceolata*), Meadow Buttercup, Marsh Thistle and Pointed Spear-moss. This area was scrubbing over with Grey Willow (*Salix cinerea* ssp*. oleifolia*) and Gorse (*Ulex europaeus*) (Annex III, Plate 7 & 8).

Of the three surveyed areas, only the middle area had potential for supporting any of the three target *Vertigo* spp. The area of *Schoenus* fen area was assessed as being of Suboptimal suitability for supporting *V. moulinsiana*, due to the vegetation present and the wetness level (Annex II, Figure A3). Three detailed spot samples were taken, along with a number of ad hoc samples. No *V. moulinsiana* were found in the course of the sampling. Details of the spot samples taken for *V. moulinsiana* at Raheenduff are presented in Annex I, Table A4.

The same area of *Schoenus* fen supported small areas that were more flushed and calcareous in nature, supporting Long-stalked Yellow Sedge, Yellow Starry Feather-moss and Rusty Hook-moss. This area was suitable for supporting *V. geyeri* and the overall habitat suitability of the fen area for *V. geyeri* was classified as Optimal-Suboptimal (Annex II, Figure A4). One spot sample was taken, which was negative for *V. geyeri*. Details of the spot sample taken for *V. geyeri* at Raheenduff are presented in Annex I, Table A5.

Despite containing habitat that had the potential to support *V. moulinsiana* and *V. geyeri*, these species were not found at the site. The site had no suitable habitat for *V. angustior*.

5.4 Annaghmore

The site at Annaghmore comprised areas of wet grassland (GS4) at the bottom of pasture fields at Annaghmore, Co. Offaly (Annex II, Figure A5). The wettest areas contained poached depressions dominated by Hard Rush, with Silverweed, Red Clover, Yorkshire Fog, Soft Rush, Meadow Buttercup and Tormentil (Annex III, Plate 9 & 10). Drains ran along the southern and eastern boundary of the fields.

This site had no habitat suitable for supporting any of the three target *Vertigo* species, due to the vegetation present and the dry substratum.

5.5 Coolfin Glebe

The site at Coolfin Glebe comprised an area of Transition mire and quaking bog (PF3) at Coolfin Glebe, Co. Offaly (Annex II, Figure A6). The site is in a depression with the surround land rising in all directions. Much of the site was underwater, with depths of over 50 cm in places. The area to the west of the road has been 'improved' for agriculture and no longer has any potential for any of the target *Vertigo* species and so the remaining description relates to the habitat to the east of the road.

The majority of the site supports Water Horsetail (*Equisetum fluviatile*), Bottle Sedge (*Carex rostrata*), Bogbean (*Menyanthes trifoliata*), Water mint (*Mentha aquatica*), Common Cottongrass (*Eriophorum angustifolium*) and Hooked Scorpion-moss (*Scorpidium scorpioides*) (Annex III, Plates 11 & 12), with patches of Common Reed (*Phragmites australis*) across the middle from east to west. The southwestern area supports Black Bog-rush. The stonewort *Chara hispida* was recorded from the site.

Based on the vegetation present and the wetness levels, the site was deemed to have Suboptimal suitability for *V. moulinsiana* (Annex II, Figure A7). Six detailed spot samples were taken, along with a number of ad hoc samples. No *V. moulinsiana* were found in the course of the sampling. Details of the spot samples taken for *V. moulinsiana* at Coolfin Glebe are presented in Annex I, Table A6.

Despite containing habitat that had the potential to support *V. moulinsiana*, this species was not found at the site. The site had no suitable habitat for *V. angustior or V. geyeri*.

5.6 Pass

The site at Pass (also referred to as Coagh Upper Fen) comprised an area of species-rich wet grassland (GS4) at Pass, Co. Offaly (Annex II, Figure A8). This site was located at the bottom of an area of agricultural grassland. It was a mosaic of Purple Moor-grass-dominated and Black Bog-rush-dominated wet grassland (Annex III, Plate 13 & 14). Other species present included Hard Rush, Blunt-flowered Rush (*Juncus subnodulosus*), Yorkshire Fog, Water Mint, Tormentil, Meadow Buttercup, Marsh Thistle, Meadow Thistle (*Cirsium dissectum*) and Common Marsh-bedstraw (*Galium palustre*), with Pointed Spear-moss forming the moss layer.

This site had no habitat suitable for supporting any of the three target *Vertigo* species, due to the vegetation present and the dry substratum.

5.7 Derrinclare

The site at Derrinclare comprised an area of cut-over bog at Derrinclare, Co. Offaly (Annex II, Figure A9). Adjacent to the road, the vegetation was dominated by Brambles, Common Nettle (*Urtica dioica*), Gorse and Grey Willow. This gave way to patches dominated by Purple Moor-grass with Meadowsweet, Tormentil, Marsh Cinquefoil (*Comarum palustre*), Glaucous Sedge, Meadow Thistle and Common Marsh-bedstraw, surrounded by Grey Willow, Gorse and birch (*Betula* spp.) (Annex III, Plate 15 & 16). Further east, Heather (*Calluna vulgaris*) and Cross-leaved Heath started to appear, with Royal Fern (*Osmunda regalis*) also present. A deep watercourse ran along the northern boundary of the site, which has contributed to the drying out.

This site had no habitat suitable for supporting any of the three target *Vertigo* species, due to the vegetation present and the dry, non-calcareous substratum.

6 Conclusion

None of the three target *Vertigo* species (*V. angustior*, *V. geyeri* or *V. moulinsiana*) were recorded in the course of the survey. There was no suitable habitat found at four of the surveyed sites: Derrycrib, Co. Kildare and Annaghmore, Pass and Derrinclare, Co. Offaly. Suitable habitat for *V. moulinsiana* and *V. geyeri* was found at Raheenduff, Co. Offaly, while suitable habitat for *V. moulinsiana* was found at Coolfin Glebe. Despite the presence of suitable habitat, however, the target species were not present.

Based on the results of this survey, the proposed pipeline route will not impact on any populations of the three Annex II *Vertigo* species.

7 References

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Annex I – Tables

Table A1. Special Areas of Conservation (SACs) for which *Vertigo angustior* is a Qualifying Interest.

Site code	Site name	County
000190	Slieve Tooey/Tormore Island/Loughros Beg Bay SAC	Donegal
000213	Inishmore Island SAC	Galway
000396	Pollardstown Fen SAC	Kildare
000458	Killala Bay/Moy Estuary SAC	Mayo/Sligo
000622	Ballysadare Bay SAC	Sligo
000627	Cummeen Strand/Drumcliff Bay (Sligo Bay) SAC	Sligo
001398	Rye Water Valley/Carton SAC	Kildare/Meath
001680	Streedagh Point Dunes SAC	Sligo
001932	Mweelrea/Sheeffry/Erriff Complex SAC	Mayo
001975	Ballyhoorisky Point to Fanad Head SAC	Donegal
002012	North Inishowen Coast SAC	Donegal
002158	Kenmare River SAC	Cork/Kerry
002250	Carrowmore Dunes SAC	Clare

Table A2. Special Areas of Conservation (SACs) for which *Vertigo geyeri* is a Qualifying Interest.

Site code	Site name	County
000147	Horn Head and Rinclevan SAC	Donegal
000197	West of Ardara/Maas Road SAC	Donegal
000396	Pollardstown Fen SAC	Kildare
000576	Fin Lough (Offaly) SAC	Offaly
000623	Ben Bulben, Gleniff and Glenade Complex SAC	Leitrim/Sligo
000633	Lough Hoe Bog SAC	Mayo/Sligo
000859	Clonaslee Eskers and Derry Bog SAC	Laois
001090	Ballyness Bay SAC	Donegal
001482	Clew Bay Complex SAC	Mayo
001626	Annaghmore Lough (Roscommon) SAC	Roscommon
001922	Bellacorick Bog Complex SAC	Mayo
001932	Mweelrea/Sheeffry/Erriff Complex SAC	Mayo
002006	Ox Mountains Bogs SAC	Mayo/Sligo
002147	Lisduff Fen SAC	Offaly

Table A3. Special Areas of Conservation (SACs) for which *Vertigo moulinsiana* is a Qualifying Interest.

Site code	Site name	County
000174	Curraghchase Woods SAC	Limerick
000396	Pollardstown Fen SAC	Kildare
000571	Charleville Wood SAC	Offaly
000869	Lisbigney Bog SAC	Laois
001387	Ballynafagh Lake SAC	Kildare
001398	Rye Water Valley/Carton SAC	Kildare/Meath
002141	Mountmellick SAC	Laois
002162	River Barrow and River Nore SAC	Carlow/Kildare/Kilkenny/Laois/ Offaly/Tipperary/Waterford/ Wexford

Table A4. Details for *V. moulinsiana* spot samples at Raheenduff, Co. Offaly

Sample ID	Ra_Vm_S1	Ra_Vm_S2	Ra_Vm_S3
Date	23-07-20	23-07-20	23-07-20
Habitat Suitability	Suboptimal	Suboptimal	Suboptimal
Sample result	Negative	Negative	Negative
Slope (°)	3	3	3
Aspect	ENE	ENE	NNE
Average veg height (cm)	90	80	80
Maximum veg height (cm)	100	130	110
Wetness	3	4	4
Fossitt habitat	PF1	PF1	PF1
Weather	Recent rain	Recent rain	Recent rain
Grazers	Present	Present	Present
Grazer type	Cattle, horses	Cattle, horses	Cattle, horses
Grazing level	Low	Low	Low
ITM_X	640638	640618	640602
ITM_Y	719884	719881	719860
Vegetation	*Schoenus nigricans, Molinia caerulea, Potentilla erecta*	*Schoenus nigricans, Molinia caerulea, Potentilla erecta*	*Schoenus nigricans, Molinia caerulea, Juncus subnodulosus*

Table A4. Details for *V. geyeri* spot sample at Raheenduff, Co. Offaly

Sample ID	Ra_Vg_S1
Date	15-07-20
Habitat suitability	Optimal
Sample result	Negative
Slope (°)	5
Aspect	NE
Average veg height (cm)	10
Maximum veg height (cm)	100
Wetness	Optimal
Fossitt habitat	PF1
Weather	Dry, cloudy
Grazers	Present
Grazer type	Cattle, horses
Grazing level	Low
ITM_X	640608
ITM_Y	719855
Vegetation	*Schoenus nigricans, Campylium stellatum, Scorpidium revolvens, Carex viridula ssp. brachyrrhyncha,*

Table A5. Details for *V. moulinsiana* spot samples at Coolfin Glebe, Co. Offaly

Sample ID	Co_Vm_S1	Co_Vm_S2	Co_Vm_S3	Co_Vm_S4	Co_Vm_S5	Co_Vm_S6
Date	21-07-20	21-07-20	21-07-20	21-07-20	21-07-20	21-07-20
Habitat suitability	Suboptimal	Suboptimal-Unsuitable	Suboptimal-Unsuitable	Suboptimal	Suboptimal-Unsuitable	Suboptimal-Unsuitable
Sample result	Negative	Negative	Negative	Negative	Negative	Negative
Slope (°)	0	0	0	0	0	0
Aspect	None	None	None	None	None	None
Average veg height (cm)	50	30	30	160	60	60
Maximum veg height (cm)	90	70	70	180	80	80
Wetness	4	5	4	5	3	5
Fossitt habitat	PF3	FS2	PF3	FS1	FS1	FS1
Weather	Dry, sunny	Dry, sunny	Dry, sunny	Dry, sunny	Dry, sunny	Dry, sunny
Grazers	Present	Present	Present	Present	Present	Present
Grazer type	Cattle	Cattle	Cattle	Cattle	Cattle	Cattle
Grazer number	20	20	20	20	20	20
Grazing level	Low	Low	Low	Low	Low	Low
ITM_X	619832	619819	619955	619976	619946	619903
ITM_Y	711049	711110	711109	711119	711170	711174
Vegetation	*Schoenus nigricans, Carex viridula ssp. brachyrrhyncha, Eriophorum angustifolium, Scorpidium scorpioides*	*Phragmites australis, Menyanthes trifoliata, Carex rostrata*	*Menyanthes trifoliata, Equisetum fluviatile, Carex nigra, Scorpidium scorpioides*	*Phragmites australis, Equisetum fluviatile, Menyanthes trifoliata*	*Equisetum fluviatile, Carex rostrata, Mentha aquatica*	*Equisetum fluviatile, Menyanthes trifoliata, Carex rostrata*

Annex II – Maps

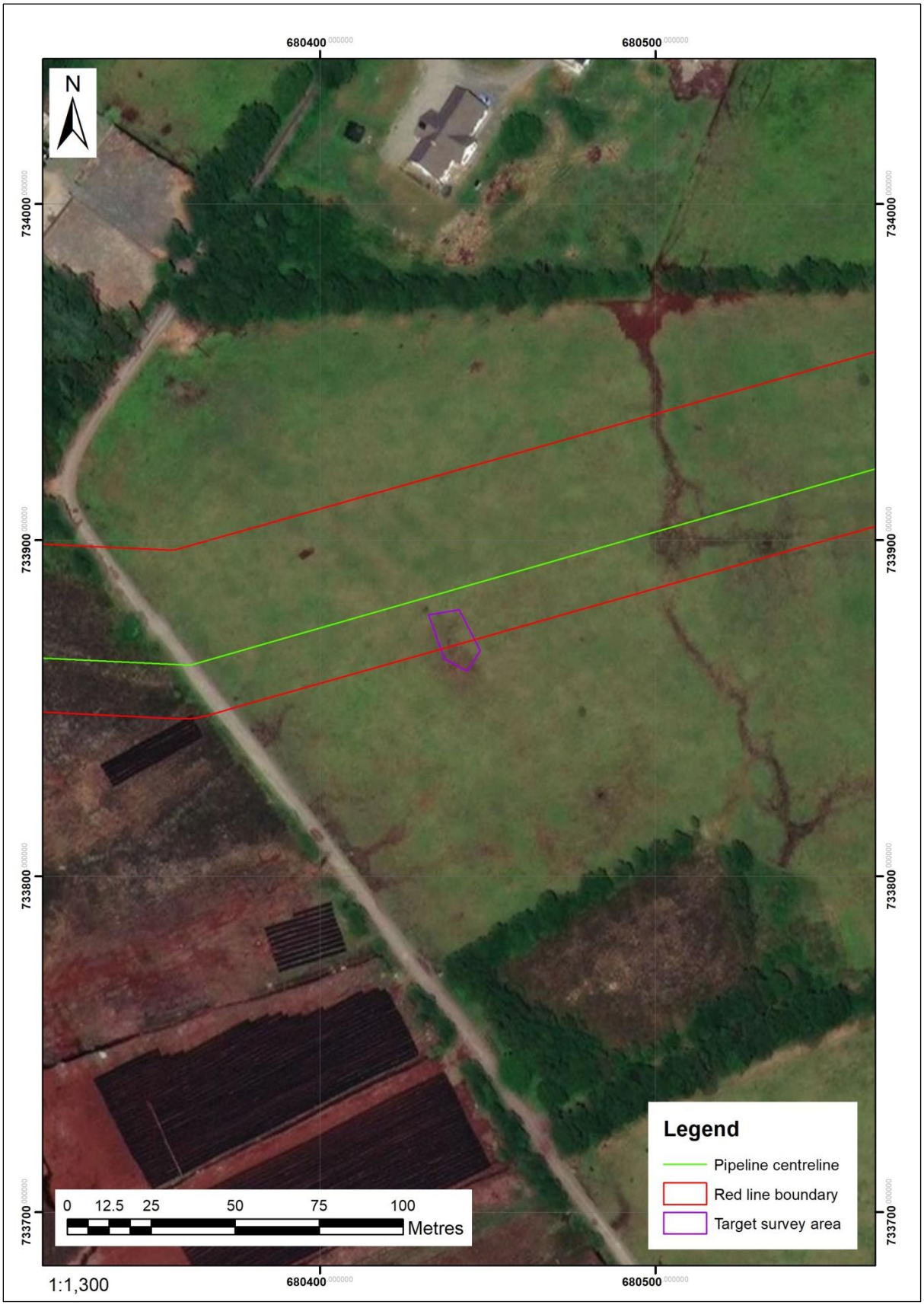

Figure A1. Map of *Vertigo* spp. survey site at Derrycrib, Co. Kildare. No suitable habitat present. Note: Red Line Boundary refers to the Project Boundary at time of survey.

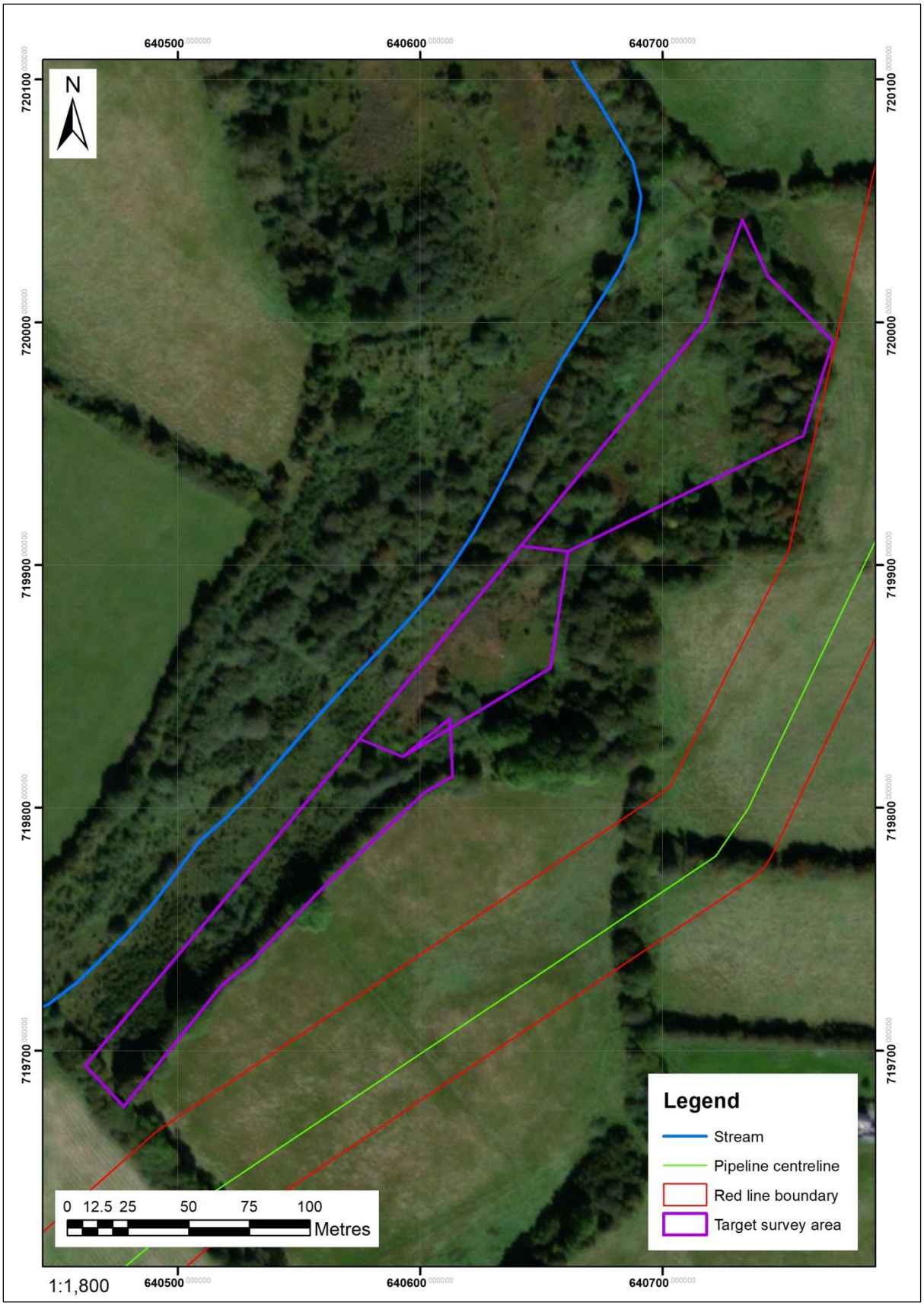

Figure A2. Map of *Vertigo* spp. survey site at Raheenduff, Co. Offaly. Note: Red Line Boundary refers to the Project Boundary at time of survey.

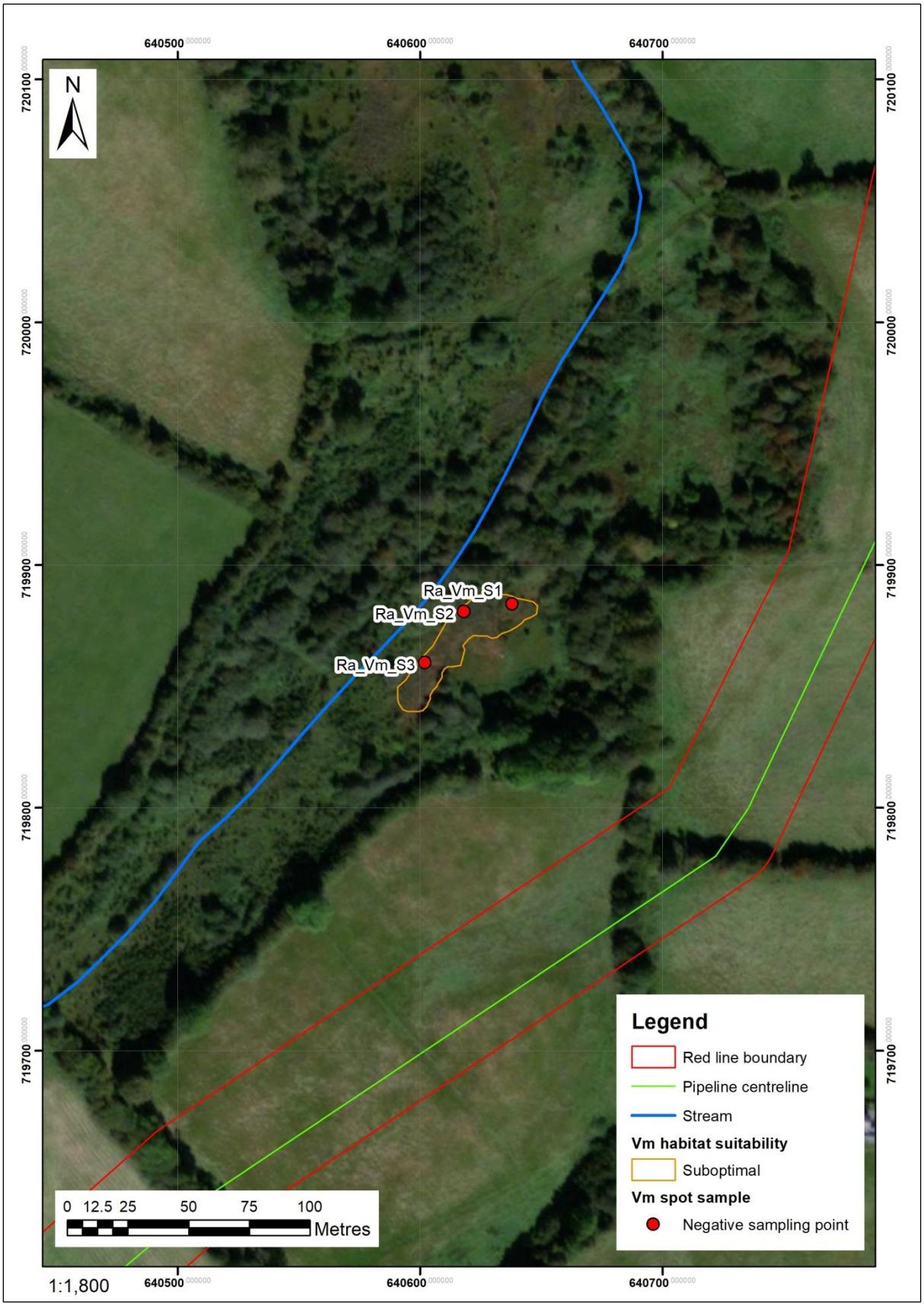

Figure A3. Map of *Vertigo moulinsiana* habitat and sample locations at Raheenduff, Co. Offaly. Note: Red Line Boundary refers to the Project Boundary at time of survey.

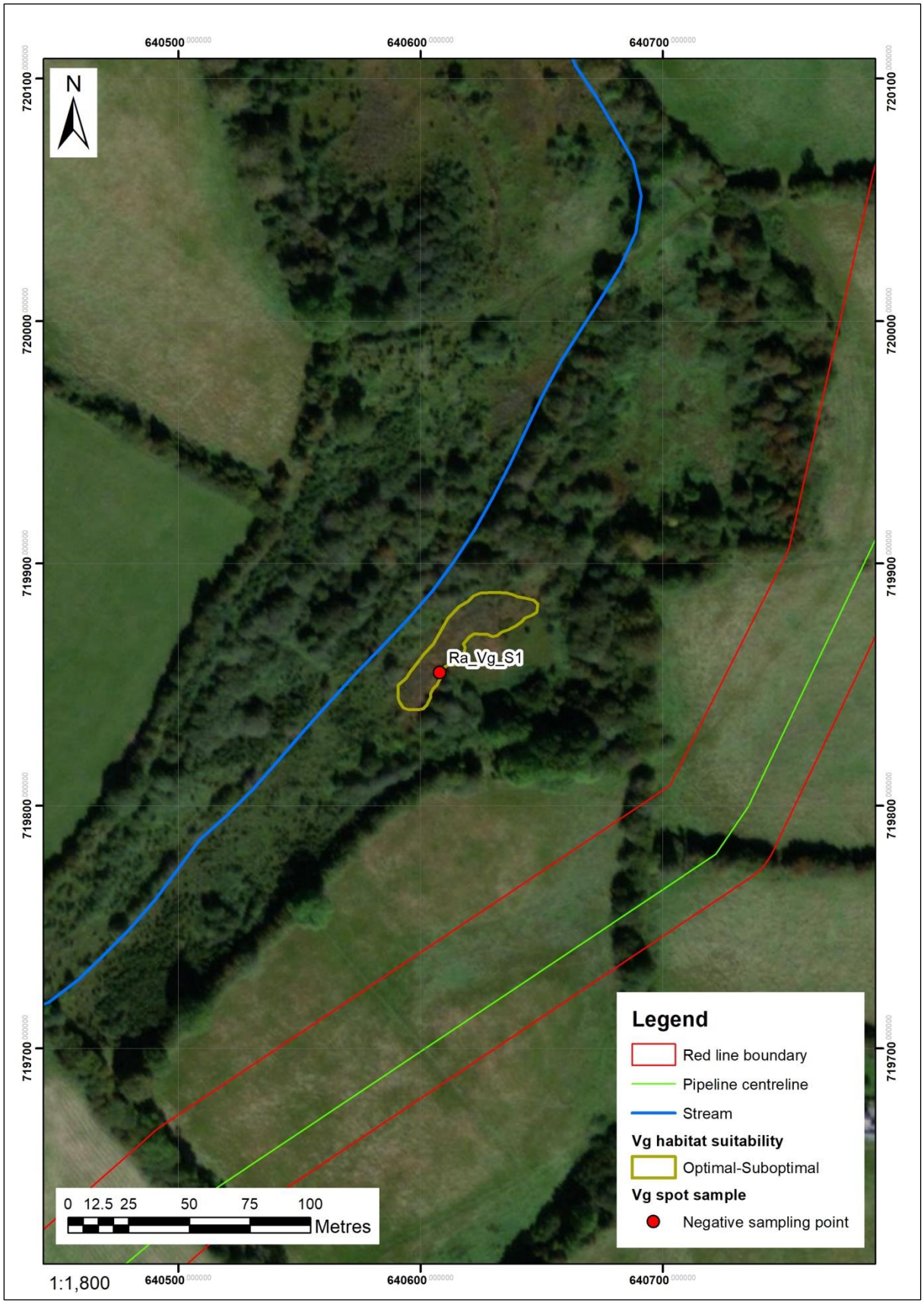

Figure A4. Map of *Vertigo geyeri* habitat and sample location at Raheenduff, Co. Offaly. Note: Red Line Boundary refers to the Project Boundary at time of survey.

Figure A5. Map of *Vertigo* spp. survey site at Annaghmore, Co. Offaly. No suitable habitat present. Note: Red Line Boundary refers to the Project Boundary at time of survey.

Figure A6. Map of *Vertigo* spp. survey site at Coolfin Glebe, Co. Offaly. Note: Red Line Boundary refers to the Project Boundary at time of survey.

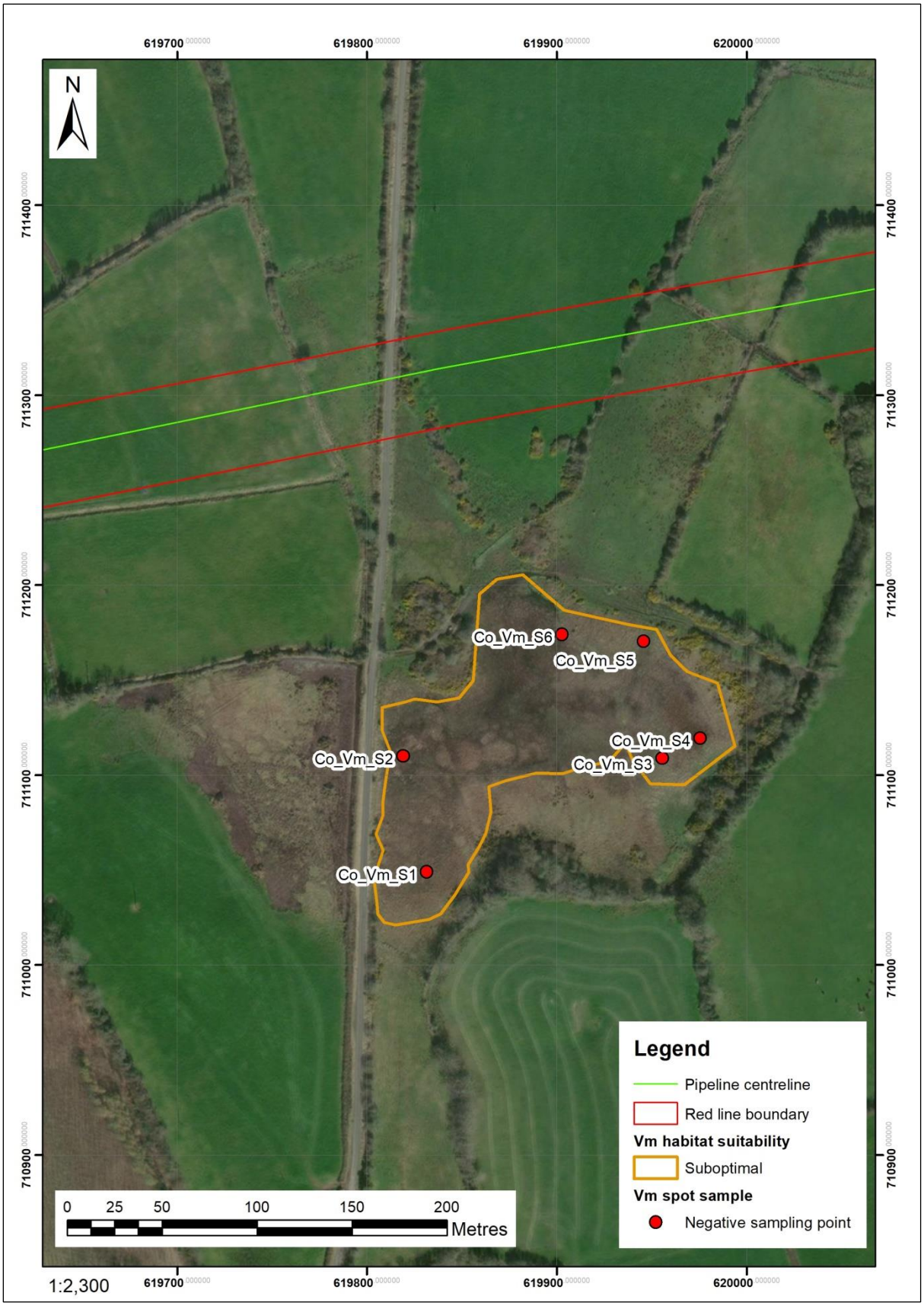

Figure A7. Map of *Vertigo moulinsiana* habitat and sample locations at Coolfin Glebe, Co. Offaly. Note: Red Line Boundary refers to the Project Boundary at time of survey.

Figure A8. Map of *Vertigo* spp. survey site at Pass, Co. Offaly. No suitable habitat present. Note: Red Line Boundary refers to the Project Boundary at time of survey.

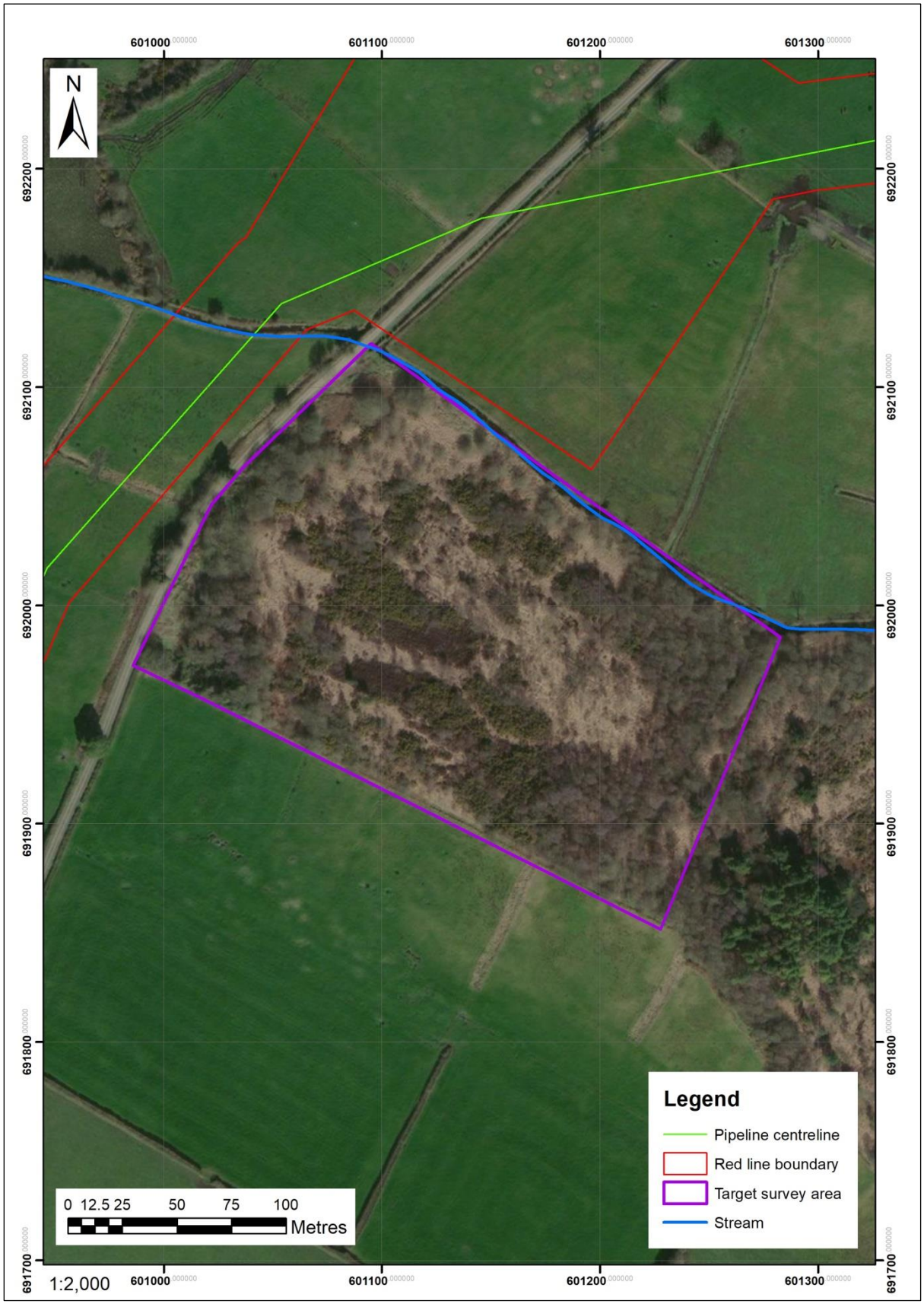

Figure A9. Map of *Vertigo* spp. survey site at Derrinclare, Co. Offaly. No suitable habitat present. Note: Red Line Boundary refers to the Project Boundary at time of survey.

Annex III - Photographs

Plate 1. Close up of habitat at Derrycrib, Co. Kildare

Plate 2. View across habitat to south-southeast at Derrcrib, Co. Kildare

Plate 3. Close up of habitat in the northern area at Raheenduff, Co. Offaly

Plate 4. View across habitat to south in the northern area at Raheenduff, Co. Offaly

Plate 5. Close up of habitat in the middle area at Raheenduff, Co. Offaly

Plate 6. View across habitat to northwest in the middle area at Raheenduff, Co. Offaly

Plate 7. View across habitat to south in the southern area at Raheenduff, Co. Offaly

Plate 8. View across habitat to north in the southern area at Raheenduff, Co. Offaly

Plate 9. Close up of habitat in the southern-most field at Annaghmore, Co. Offaly

Plate 10. View across habitat to north in the southern-most field at Annaghmore, Co. Offaly

Plate 11. Close up of habitat at Co_Vm_S03 at Coolfin Glebe, Co. Offaly

Plate 12. View across habitat to south at Co_Vm_S03 at Coolfin Glebe, Co. Offaly

Plate 13. Close up of habitat at Pass, Co. Offaly

Plate 14. View across habitat to east at Pass, Co. Offaly

Plate 15. Close up of habitat at Derrinclare, Co. Offaly

Plate 16. View across habitat to east at Derrinclare, Co. Offaly

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