

APPLICATION BY NATIONAL GRID ELECTRICITY TRANSMISSION PLC
FOR
A DEVELOPMENT CONSENT ORDER
PURSUANT TO SECTION 37 PLANNING ACT 2008
FOR
THE NORWICH TO TILBURY ELECTRIC LINE ABOVE GROUND

PLANNING INSPECTORATE REFERENCE: EN020027

DEADLINE 6: 7TH JULY 2026

On behalf:

Interested Party Reference Number: [REDACTED]

CAH 3: WRITTEN SUBMISSIONS OF ARU WRITTLE

INTRODUCTION

1. These are the Written Submissions of “ARU Writtle” (being the collective trading name and trademark for the entities: Anglia Ruskin University (“ARU”) and Writtle College Limited (“WCL”)) for Deadline 6 in the Examination by the Examining Authority (“ExA”) of the application, reference EN020027, for a development consent order (“DCO”) for a nationally significant infrastructure project (“NSIP”) within section 14(1)(b) of the Planning Act 2008 (“PA 2008”), on the draft terms of the DCO submitted in August 2025 (“the dDCO”) by National Grid (“NGET”), for the “installation of an electric line above ground” across East Anglia between Norwich and Tilbury (“the Scheme”). For the purposes of these submissions, references to ARU include WCL.
2. The Examination is required by section 98(1) of the PA 2008 to conclude on the 10th August 2026 at the end of the 6 month statutory period provided for the evaluation of the facts, opinions and unsworn assertions submitted in that Period.

3. On the 24th June 2026, the ExA held an Issue Specific Hearing (“ISH”) entitled “Compulsory Acquisition Hearing 3” (“CAH3”).
4. At CAH 3:
 - a) NGET affirmed to the ExA that in fact it did not actually need (nor require) Plot 8/42 of the ARU land, and undertook to the ExA to classify that Plot as “Class 8” land. “Class 8” land is the name given by NGET to land inside of the red outlined area of its draft DCO that: i) has no colour; and ii) to which the Articles of the dDCO are “N/A” or “not applicable”;
 - b) “UKPN” affirmed to the ExA that in fact:
 - i) a design development agreement having been agreed with NGET in November 2025;
 - ii) it had only from late March 2026 begun corresponding with some 200 land owners of land areas inside the red outlined area of the draft DCO;
 - iii) more recently was actually communicating with each of them (including ARU), with a view (as is the “procedure” of “UKPN”) to agreeing bespoke terms with each such party; thereby
 - iv) (as at 24th June 2026) “UKPN” was unable to yet conclude itself whether or not the compulsory acquisition of the interest of a given land owner was necessary (or required) by it.
5. These Deadline 6 Written Submissions derive from CAH 3.
6. The Submissions are supported, and evidenced, by the further following evidence (including sworn evidence) from and on behalf of ARU:
 - a) **Third Witness Statement of Caroline Flanagan** and Exhibits including the research Article by expert Rosa Verwijns MSc FHEA CEBC ABTC-AAB;
 - b) **Third Witness Statement of Jane Kenny** and Exhibits;
 - c) **Second Witness Statement of Michelle Lawlor-Perkins** and Exhibits;
 - d) **Second Technical Note of Joseph Hough** of KMC Transport Planning; and
 - e) **Witness Statement of Tom Newcombe** and Exhibits (showing the necessary deletions of Plot 8/42 from the draft development consent order and its certified documents including Plans).

EXECUTIVE SUMMARY

7. These Deadline 6 Written Submissions by ARU, their supporting **Appendices A-C** herein, and the accompanying evidence above, explain and evidence the basis for requiring the imposition of micro-siting protective provisions (else a Requirement to like effect) by which to ensure as follows:

- a) The creation of a micro-siting notional 'gateway': i) inside of the proposed "Rochdale" Envelope; and ii) outside of the paddock areas immediately South of the footpath within Plot 8/29; through which can traverse the NGET overhead electrical lines simultaneously inside of the Westernmost extent of the Limits of Deviation within that Envelope. This micro-siting gateway ensures that the law relating to compulsory purchase and relevant guidance are complied with and the continuation of the safe functioning of ARU Writtle Educational Establishment ("the NGET Micro-Siting Gateway Provision");
- b) The creation of a sub-surface micro-siting notional 'gateway': i) inside of the proposed "Rochdale" Envelope; and ii) below the ground level surface of the paddock areas immediately South of the stream footpath within Plots 8/27, 33 and 36; through which can traverse by horizontal direct drilling the electrical lines of Eastern Power Networks plc (as the sole licensed distributor) simultaneously. This micro-siting gateway ensures that the law relating to compulsory purchase and relevant guidance are complied with and the continuation of the safe functioning of ARU Writtle Educational Establishment ("the Eastern Power Networks plc Micro-Siting Below Ground Gateway Provision");
- c) The absence of scaffolding situated on paddock ground surfaces of ARU Writtle adjacent to Newney Green Lane highway during the limited period of 4 hours contended by NGET for closure of the use of that highway during its cable installation between two pylons inside of the construction site of the said Envelope ("the Scaffolding Provision");
- d) The provision of clear express terms to ensure the safe crossing of Cow Watering Lane by ARU horses, students and staff during the diversion by NGET of traffic along that Lane and its use by NGET construction vehicles ("the ARU Safe Crossing Provision").

8. The terms of the provisions for the protection of ARU Writtle are as follows.

a) the NGET Micro-Siting Gateway Provision

For the protection of ARU Writtle, in relation to any electrical transmission line in Works No.17, Part V of the development consent order cannot apply to the extent of Fields 4, 5, 6 and 7 in Plot 8/37 and Plot 8/29) situated to the South of the footpath running East [at grid reference [insert]] from Newney Green Lane.

b) the Eastern Power Networks plc Micro-Siting Below Ground Gateway Provision

For the protection of ARU Writtle, Part V of the development consent order cannot apply to the extent of Fields 8, Park 1 and Park 2 (identified as Plot 8/27 and Plot 8/33 and Plot 8/36).

Eastern Power Networks plc may below a depth of 1m beneath the ground surface level of the said Plots install and keep an electrical distribution line inside of the Order Limits as they relate to ARU Writtle, unless otherwise agreed in writing by ARU Writtle.

c) the Scaffolding Provision

For the protection of ARU Writtle, in relation to the construction of Works No.17, Part V of the development consent order cannot apply to the extent of Fields 4, 5, 6 and 7 (identified as Plot 8/29, Plot 8/37 and Plot 8/38).

d) the ARU Safe Crossing Provision

For the protection of ARU Writtle, no diversion of traffic along Cow Watering Lane can occur without suitable traffic safety measures being agreed with Essex County Council and carried out by the Applicant.

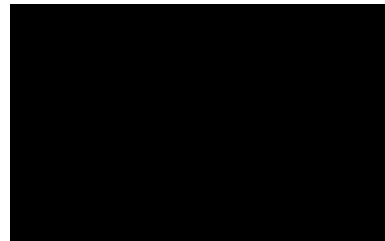
9. The Response of NGET at page 29, Row 1, Column 2 of its Deadline 2 “Applicant’s Comments on Written Representations” [REP2-029] is overtaken by its evidence of the 24th June 2026 to the ExA :

The Applicant has set out compelling reasons to justify its case for powers affecting the Equine Facility and Plot 8/42 required for the Project (including in respect of access and rights) in accordance with all applicable statute and consistent with case law. The case is strongly in the public interest. This is not a case where the scales are evenly balanced requiring doubt therefore to be resolved in favour of the affected person. Suitable alternative land is not available. Nothing in the case cited alters the analysis in those documents about the compelling need for the powers proposed.

10. Following the affirmation on 24th June 2024 by NGET that Plot 8/42 is not necessary for its project, and its undertaking to remove the yellow colouration from Plot 8/42 and denote it as “Class 8” land in Table 1.1 of Appendix A to the Statement of Reasons (Document 4.1), it remains the case that the perimeter red line of the now void land be reduced to exclude that Plot from all Section F, Sheet 8 drawings.
11. Due to NGET remaining wedded to its asserted need, ARU Writtle has been driven to Object to NGET’s draft development consent order flawed by inclusion of the unnecessary Plot 8/42 and Part V powers for “UKPN”, and to incur substantial costs and. As at 24th June 2026, ARU is a partly successful Objector for the purposes of the PA 2008 and section 122 and the ExA must advise the SoS of the same.

12. That NGET has misunderstood the law of CPO and the basic obligation that CPO is a remedy of “last” and can never be a “first” resort, misdirected itself in relation to its own evidence of fact that operates against it, and the resiled on 24th June 2026 from its (strongly but) asserted position in its [REP2-029] of April 2026 (only some two months earlier) evidences that the ExA pay *particularly close scrutiny* to the NGET assertions.
13. As was said in *Prest*, and never was it more apposite than in this particular application in light of CAH 3:

*The use of statutory authority for the destruction of those rights requires to be **most carefully scrutinised**.*



7 July 2026

APPENDIX A

WRITTEN SUBMISSIONS

14. The reader is referred to the **Appendices B-C** below, to the previous Written Submissions sworn evidence, and case law accompanying the Submissions of ARU. For convenience (only), elements of the foregoing are repeated in the **Appendices B (Facts) and Appendix C (Law)** below. These Appendices should be read before reading the following submissions in Sections A-D in **Appendix A** herein.

A. Legal Framework

15. In summary and for convenience, the Legal Framework for this Deadline 6 Written Submission is as follows.

16. By section 103(1) of the PA 2008, the Secretary of State for Energy and Climate Change (“the SoS”) has the function of deciding “an application for an order granting development consent”. That function follows: a) a statutory examination period of the facts and evidence; b) a statutory period for commendations by the ExA to the SoS. As part of the statutory framework in which decisions are required to be taken, following the cessation of the statutory 6 month period under section 98(1) and the 3 month period in which the ExA must report on the application, the SoS is required by section 107(1) to decide an application for an order granting development consent by the end of the period of 3 months (or as may be extended). By section 114(1), when the SoS has decided an application for an order granting development consent, he must either make the order or refuse development consent.

17. By section 104(2), the SoS is required to “have regard to” specified matters including:

- a) *any national policy statement which has effect in relation to development of the description to which the application relates (a “relevant national policy statement”)...*

but, by subsection (3): (Emphasis added)

The Secretary of State must decide the application in accordance with any relevant national policy statement.

18. In this matter, NPS EN-3 and EN-5 (November 2023) apply.

19. Returning to the PA 2008, within Chapter 1 of Part 7, section 120(1)-(9) is logically prior to section 104 and provides for what can (and cannot) be included in a particular “order granting development consent” that is the subject of the given application before the SoS can decide the application under sections 104 and 114.

20. Section 120(2) provides for “requirements” (“Requirements”) that correspond to conditions that could be imposed on the grant of any permission, consent or authorization.

21. Section 120(3)-(6) provides for “provisions” that may be included in an order and also what an order may be include and do in respect of other legislation and, further, may include “any provision that appears to the Secretary of State to be necessary or expedient for giving full effect to any other provision of the order. Schedule 5, Part 1, includes provisions that include, under Paragraph 10: “The protection of the property or interests of any person.”

22. Most importantly, section 120(7) provides: (Emphasis added)

Subsections (3) to (6) are subject to subsection (8) and the following provisions of this Chapter.

23. The hinge point results to posit: a) consideration of “requirements” under section 120(2) in relation to the consideration of the application for the authorized development; and b) consideration of “protective provisions” in relation to the consideration of compulsory purchase matters. The difference between a “requirement” and a “protective provision” is further illustrated by section 153 and Schedule 6, paragraph 3(1) and The permanency of a protective provision is ensured by section 153 and Schedule 6, paragraph 3(1) and 5(2) and (3)(a) that provides a long stop in respect of the ability to change a protective provision.

24. Returning to section 120(7), “*the following provisions of this Chapter*” include section 122.

25. Section 122, “Purpose for which compulsory acquisition may be authorized”, provides:

- 1) *An order granting development consent may include provision authorising the compulsory acquisition of land only if the Secretary of State is satisfied that the conditions in subsections (2) and (3) are met.*
- 2) *The condition is that the land—*
 - a) *is required for the development to which the development consent relates,*
 - b) *is required to facilitate or is incidental to that development, or*
 - c) *...*
- 3) *The condition is that there is a compelling case in the public interest for the land to be acquired compulsorily.*

26. On its face, section 122 concerns “*the compulsory acquisition of land*”. NGET has included as part of its application Part V of the dDCO by which it seeks compulsory purchase powers for itself and also for a third party “UKPN” and in relation to land that includes part of the land of ARU Writtle.

27. In respect of the correct construction of section 122 in its statutory context of section 120(7) (and so also 120(3)-(6)), in *R(oao Sainsbury’s Supermarkets Ltd) Wolverhampton City Council* [2011] 1 AC 437, the Supreme Court held: (Emphasis added)

11. Recently, in the High Court of Australia, French CJ said in *R & R Fazzolari Pty Ltd v Parramatta City Council* [2009] HCA 12, paras 40, 42, 43:

“40. Private property rights, although subject to compulsory acquisition by statute, have long been hedged about by the common law with protections. These protections are not absolute but take the form of interpretative approaches where statutes are said to affect such rights.”

“42. The attribution by Blackstone, of caution to the legislature in exercising its power over private property, is reflected in what has been called **a presumption, in the interpretation of statutes, against an intention to interfere with vested property rights** ...

“43. The terminology of ‘presumption’ is linked to that of ‘legislative intention’. As a practical matter it means that, **where a statute is capable of more than one construction, that construction will be chosen which interferes least with private property rights.**”

28. On its correct construction, it is evident that section 120(3)-(6) are expressly subject to subsection (7), that subsection (7) concerns “the compulsory acquisition of land”, and that the body of case law relating to “the compulsory acquisition of land” applies to the legal scope, interpretation of, and assessment under section 122 in respect of the given facts.

29. On the correct construction and interpretation of:

- a) section 120(7), the PA 2008 differentiates between the decision-making provisions under section 120(1) and (2), and that under section 120(3)-(6) by means of expressly subjugating (3)-(6) to the terms of section 122;
- b) section 120(7) and section 122, the PA 2008 elevates section 122 above the terms of section 120(3)-(6) (else section 120(7) would be otiose);

30. So differentiated, the common law requires the correct approach to assessment of compulsory acquisition law and matters under section 122 itself as follows.

31. On its correct construction and interpretation, section 122:

- a) Contains “a presumption, in the interpretation of statutes, against an intention to interfere with vested property rights”. See *Sainsbury’s* case. Consequently, the guidance “presumption” in NPS EN-3 (2023) in favour of the authorized development cannot override the legal presumption operating against the inclusion of compulsory purchase powers in the consideration of section 122. That guidance presumption applies alone to the non- compulsory purchase parts of the authorized development;

- b) Contains by necessary implication the purpose of its being “*primarily enacted for the protection of such a person*” as the landowner or occupier and so requires an interpretation “*which is favourable to the owner and occupier of the land ...*” . See *Chilton v Telford Development Corporation* [1987] 1 WLR 872.

32. In applying section 122, the ExA and the SoS are required by the common law to consider the NGET application as follows:

- a) In their respective assessment of evidence: “*The use of statutory authority for the destruction of those rights **requires to be most carefully scrutinised.***” See *Prest*, affirmed in *Sainsbury’s* case.
- b) In their respective evaluation of the evidence, the presence of an ambiguity in the evidence must be resolved in favour of the land owner:
 - i) “*Where the scales are **evenly** balanced — for or against compulsory acquisition then the decision — by whomsoever it is made — should come down **against** compulsory acquisition.*” See *Prest*, affirmed in *Sainsbury’s* case;
 - ii) “*If there is any reasonable doubt on the matter, the balance must be resolved in favour of the citizen.*” See *Prest*, affirmed in *Sainsbury’s* case;
- c) an example of “reasonable doubt” is: “*there were alternative sites available to the local authority, including one owned by them. He said (at page 291):*

“It seems to me that there is a very long and respectable tradition for the view that an authority that seeks to dispossess a citizen of his land must do so by showing that it is necessary ... If, in fact, the acquiring authority is itself in possession of other suitable land other land that is wholly suitable for that purpose — then it seems to me that no reasonable Secretary of State faced with that fact could come to the conclusion that it was necessary for the authority to acquire other land compulsorily for precisely the same purpose.” See *Prest*, affirmed in *Sainsbury’s* case;
- d) an “alternative” is not required to replicate the contended position of the acquiring authority but to be for the “same purpose”. See *Prest*, affirmed in *Sainsbury’s* case;
- e) the common law requires no more in respect of an alternative than that it “could” result (not ‘would’ or ‘should’) in a different situation *in favour* of the landowner or occupier by which to trigger the requirement on the SoS to refuse powers of compulsory acquisition. See *Prest*, affirmed in *Sainsbury’s* case. “Could” is a low threshold in law and requires no more than evidence of an evidenced possibility of the fact together with it having the “same purpose”. That is, in law a precisely corresponding fact

is not required and nor is more than required the “same purpose” in respect of the alternative fact. See *Prest*, affirmed in *Sainsbury’s* case;

- f) only if the evidence in favour of property interference is clear cut, and the public interest is also clear cut, can such interference be justified: *“I regard it as a principle of our constitutional law that no citizen is to be deprived of his land by any public authority against his will, unless it is expressly authorised by Parliament and the public interest decisively so demands: and then only on the condition that proper compensation is paid, see Attorney-General v. De Keyser’s Royal Hotel Ltd. (1920) A.C. 508 . See *Prest*, affirmed in *Sainsbury’s* case;*
- g) there is a difference between: i) the decision to consent an order for authorized development; and ii) the decision to include compulsory acquisition provisions in the terms of the order for that development. As the Secretary of State has long since affirmed in his Compulsory Purchase Guidance relating to the PA 2008 of September 2013: “16. *There may be circumstances where the Secretary of State could reasonably justify granting development consent for a project, but decide against including in an order the provisions authorising the compulsory acquisition of the land.*”
- h) The draft DCO itself is draft legislation and will be consented not by NGET nor UKPN but by the SoS under section 114 and who in turn is bound by the foregoing case law, NPSs and national guidance. (Consistent with *Sainsbury’s* case in respect of the correct construction of legislation relating to property interference) when dealing with even open ended powers: (Emphasis added)

“...on its face an open-ended power granted to the acquiring authority to act or not to act. It may at least be questioned whether that was entirely the intention of Parliament in enacting what are essentially provisions for the protection of an owner or occupier who is subjected to the necessary, but nevertheless draconian, powers of the acquiring authority to dispossess him of his title and occupation of his land.

*For my part, in approaching the construction of these statutory provisions I have two concepts in mind: first, to give to this part of the legislation, if it is open to do so, a purposive construction, bearing in mind the general considerations and need for these provisions. Secondly, to bear in mind that it is a statute which is **depriving the citizen of his rights in property and his title, and the right to enjoy occupation of his lands, or perhaps somebody else’s lands...***

... choosing between the two alternative approaches to this legislation, and I hope fairly recognising the lacuna which exists for practical purposes in the day-to-day carrying out of these exercises, I adopt the construction which is favourable to the owner and occupier of the land, because these sections, although incidentally dealing with calculation of compensation and interest, were primarily enacted for the protection of such a person...” See Chilton [1987] 1 WLR 872.

- 33. The NGET Response, page 29, Row 1, Column 2 Deadline 2 “Applicant’s Comments on Written Representations” [REP2-029] is out of kilter with *Prest*, *Chilton*, *Sainsburys’*, and the PA 2008 CPO Guidance.

B. The NGET Micro-Siting Gateway Provision

34. In respect of ARU, the law and guidance require the creation of a micro-siting notional 'gateway': i) inside of the proposed "Rochdale" Envelope; and ii) outside of the paddock areas immediately South of the footpath within Plot 8/29; through which can traverse the NGET overhead electrical lines simultaneously inside of the Westernmost extent of the Limits of Deviation within that Envelope. This micro-siting gateway ensures that the law relating to compulsory purchase and relevant guidance are complied with and the continuation of the safe functioning of ARU Writtle Educational Establishment ("the NGET Micro-Siting Gateway Provision").
35. NGET's application for a development consent order includes both provisions for the authorized development and, in Part V of the dDCO, provisions seeking the compulsory acquisition of land that includes parts of the land of ARU Writtle.
36. In essence, NGET seeks authorization for a "Rochdale" Envelope ("the Envelope") in which to situate an authorized development comprised of proposed segments "anywhere within the Order Limits" and in particular may situate the pylons (and cables between them) anywhere within the "limits of deviation".
37. The terms of the authorized development are not expressed in detail in the dDCO. Instead, NGET has drafted the terms to form an Envelope. The Envelope creates a notional box covering an extent of land defined by the red outlined area of the "Order Limits" (that contains also the "limits of deviation"), with a particular height, and along the total length of the envisaged authorised development taken together. See Article 5 of the dDCO. Inside of the notional box would be situated the individual Works Numbers, a number of pylons, and, between each pylon, would be attached overhead electrical lines. Importantly, the actual location of the elements of the Works Numbers are not fixed nor precisely located, in particular in the vicinity of ARU land. Instead, the very concept of the Envelope creates, and provides, flexibility in respect of the future fixation of the pylons and the resulting geometry of the electrical lines spanning straight between each pylon inside of the Envelope. Only when all of the individual segments are finally constructed and energized will the authorized development be operational for its transmission of electricity.
38. The Envelope would traverse land that includes the Western part of ARU Writtle. The extent of the Envelope at ground level is shown on Section F, and Sheet 8 of the Works Plans and the Land Plans and also the Traffic Regulation Order Plans. The segment that would be situated in the Envelope near to ARU is Works No. 17. The *Envelope* would actually overlap ARU land identified, for example, as Plot 8/37 and 8/29. See ARU Writtle Plan C.

39. The part of the ARU land that would be overlapped by the Envelope contains paddocks forming part of the ARU Writtle Educational Establishment. The areas identified as Plots 8/29 and 8/37 in fact comprise particular smaller fields identified in the evidence of Caroline Flanagan as Fields “6, 7 and 8” in the Plan of the Facility.
40. That Establishment includes a herd of some 90 horses. Because the Establishment teaches both Further Education and Higher Education, the Establishment also teaches students aged 16 and upwards and, thereby, it is a school also.
41. ARU has provided to the ExA and to the SoS sworn evidence and expert evidence demonstrating that horses in the paddock areas over which the *Envelope* traverses would be subject to microshocks, and that microshocks engender in horses a significant risk of harm and injury to the horse and resultant injury and harm to the student handler or rider as well as to staff. See the Witness Statements of Caroline Flanagan, Michelle Lawlor-Perkins, and Jane Kenny, and the expert evidence research Article of Rosa Verwijs MSc, FHEA CEBC ABTC-AAB. NGET accepts that its Response to ARU Writtle Submission that its new electric lines would result in microshocks over the part of the ARU Writtle land envisaged to be oversailed by those lines and has illustrated the axis of that line in Figure 1.1 of that Submission.
42. However, the axis shown by NGET is notionally fixed in the centre line of the Limits of Deviation and also assumes the fixed location of the pylons on either side of the electrical line. That illustrative disposition of the axis is shown in Document 6.4.F1, Figure 4.1, Project Description, of the Environmental Statement.
43. At the same time as the Figures 1.1 and 4.1 referred to above, NGET has actually sought a dDCO on terms stated in Articles 3(1), and 5, that would actually entitle it to position each and every pylon in the vicinity of ARU Writtle “anywhere” inside the Order Limits and the pylons and lines anywhere inside of the Limits of Deviation inside those Order Limits. Consequently, contrary to the evidence in Figure 1.1, there is no requirement in the dDCO Article 5 on NGET to fix its lines or pylons in the position or axis (only) notionally shown in Figure 1.1.
44. Instead, the evidence of the dDCO, Articles 3(1) and 5(1) demonstrates that NGET can situate the electrical lines anywhere inside the Limits of Deviation including as far to the East or West as the edge of the Limits of Deviation. And, to like result, the pylons can be situated anywhere inside the Limits of Deviation.
45. Turning to the geometry of the Envelope and to the illustrative content of the Envelope, it is clear from Document 6.4.F1, Figure 4.1, Project Description, of the Environmental Statement, that each of a number of

individual pylons can be situated to the West or to the East or to the North or to the South of the illustrates position shown in that Figure. It can also be seen that the movement farther South of pylon reference TB165 would result to change the geometry of the line between it and pylons reference TB166 in that illustration. Conversely, the movement farther North of pylon reference TB166 would result in the change of the geometry of the electrical line between it and the pylon reference TB165 to its North-East.

46. The result of the last geometric refinement – or micro-siting – of the pylon references TB166 and TB 165 (and if also helpful, TB164) would be to move Northwards and Westwards the straight line of the electrical line between each of these pylons. Such a refinement in the geometric micro-siting of the pylons positions would result to move the electrical line between these two points from itself oversailing both of the two rectilinear paddocks to the South of the West/East footpath in the Northern part of ARU Writtle land, and instead only partly oversailing the North-Westernmost paddock of ARU Writtle on the North side of that footpath adjacent to the stream. This geometric refinement would ensure that the proposed actual electrical line between TB 166 and TB165 remained and, in turn, the “same purpose” of *the authorized development* would be served, and at the same time the authorized development would remain inside of the proposed authorized Envelope.
47. The geometric refinement described above is described in the sworn evidence of Jane Kenny and shown by her in the evidence in Plan JK. The refinement can be more clearly illustrated also by comparison of that Plan JK with Section F, Sheet 8 of the Works Plans. The Works Plans show the extent of the rectilinear paddocks adjacent to Newney Green Lane highway, and, farther West, the Western edge of the red line of the Order Limits and the line also of the Limits of Deviation. It can be seen from the Works Plan, and Plan JK, that the refined geometry engenders the passage of the electrical line inside of the Westernmost edge of the Order Limits and of the Limits of Deviation and simultaneously outside of the rectilinear paddock to the immediate South of the footpath shown as a dotted line. North of the footpath can be seen a triangle of land, and to the north of that triangle can be seen a further area bounded to its North by the curving edge of a stream. Thereby, it can be clearly seen in fact that there is a resulting gap – a gateway – inside of the Envelope, through which the electrical line can pass, but outside of the extent of the area of the rectoliner paddock areas of the ARU Writtle land. It can be also seen that the refinement Westwards of the purple line between TB166 and TB165 actually could traverse through that gateway.
48. The refinement of the electrical line geometry to pass through that gateway aligns also with the Voluntary Code of Practice: “Power Lines: Control of Microshocks and other indirect effects of public exposure to

electrical fields” (July 2013) (“the Code”) published by the Department of Energy and Climate Change. On page 6 of the Code, the Department provides guidance by which the simpler measure is to avoid creating new situations prone to microshocks and the Department advises that these “are to be preferred and adopted first”. Of these measures, page 6 describes that electrical companies (such as NGET and also UKPN) will “where reasonably practicable, avoid designing new power lines ... over schools”. Indeed, the Department advises that “existing good line-routing practice will normally achieve this anyway by routing lines away from existing homes and schools”. Indeed, the Envelope enables adherence to “good line-routing practice” by providing Order Limits and Limits of Deviation inside of which the line can be routed to “avoid” the paddocks.

49. On its correct construction of the Code, only if good practice cannot be adhered to – “if a new line over ... a school is unavoidable” – then elevated clearances can be considered.
50. In this application by NGET, because the Envelope itself evidences actual flexibility in the future siting of the pylons and the actual geometry of the inter-connecting electrical lines, it cannot be said that good practice cannot be adhered to by NGET and the line routed through the foregoing gateway, thereby actually avoiding (so far as may be avoided) the oversailing of the ARU paddock land of that school. Thereby, ARU rejects the NGET Response to ARU Writtle shown in Figure 1.1 as fundamentally misconceived, failing to adhere to, and in breach, of Departmental good line-routing practice, and instead jumps the ‘avoidance gun’ to instead elevate the proposed cables instead of merely micro-siting the cable routing in line with good practice. Further, NGET’s misconceived approach results to evidence that microshocks would occur and so would startle horses forming an intrinsic part of the Educational Establishment land use of ARU Writtle, and risk their injury and harm and likely result in injury and harm to children, students, and staff being taught and teaching at the Facility respectively.
51. Applying *Prest*, it follows that the common law requires: the inherent ambiguity in the evidence of the actual flexible content of the Envelope to be resolved in favour of ARU; the same evidence of flexibility incorporates an alternative fact of refined geometry of the electrical line inside of the Envelope in the vicinity of ARU Writtle that would serve the “same purpose” of the authorized development as the line situated farther East inside the Envelope. It further follows, in law, that no reasonable Secretary of State “could” authorize compulsory purchase powers over ARU Writtle land. Thereby, the ExA is required to so recommend the same to the SoS.
52. The foregoing geometric refinement falls to be ensured by means of section 120(3) and (4) (that by section 120(7) are expressly “subject to” section 122), and paragraph 10 of Schedule 5: “The protection of the

property or interests of any person.” On its correct construction, that paragraph is not confined (as NGET may assert) to undertakes or regulators but can encompass ARU Writtle and its land interests at its Establishment.

53. (Subject to refinement of the terms by the ExA), the terms of the Protective Provision are:

For the protection of ARU Writtle, in relation to any electrical transmission line in Works No.17, Part V of the development consent order cannot apply to the extent of Fields 4, 5, 6 and 7 in Plot 8/37 and Plot 8/29) situated to the South of the footpath running East [at grid reference [insert]] from Newney Green Lane.

54. The outcome of that Protective Provision would be to create the Eastern side of the gateway referred to above and, thereby, leave the actual gap between that side and the Western edge of the Order Limits as the notional space through which the electrical line could traverse. Such a provision leaves the particular micro-siting of pylons references TB 165 and TB166 (and others) to ensure the passage of the line through the resulting gateway to NGET, and, thereby, maintains some flexibility in the final particular location of the pylons themselves.

55. A similar outcome could be ensured by the imposition of a similarly worded Requirement.

B. The Eastern Power Networks plc Micro-Siting Below Ground Gateway Provision

56. In respect of ARU, the law and guidance require the removal of Part V powers in the draft development consent order in relation to “UKPN” as a result of the breach of paragraph 2.6.3 of NPS EN-5 (2023) and section 104(3) of the PA 2008 from the inclusion of those powers by NGET in its application on the 29th August 2025 before the (still pending) event of “UKPN” itself concluding whether or not it needs such powers.

57. In those circumstances, ARU proposes to facilitate by agreement the installation by Eastern Power Networks plc of below ground and horizontally direct drilled electricity distribution lines under ARU land simultaneously preserving the ongoing safe operation of ARU Writtle as a teaching establishment and its horse herd.

58. To that end, ARU proposes a protective provision that disapplies Part V in respect of “UKPN” in relation to ARU land but authorizes Eastern Network Power plc to so install and keep its cables below the ground of ARU by means of the creation of a micro-siting notional below ground ‘gateway’: i) inside of the proposed “Rochdale” Envelope; and ii) below the ground level surface of the paddock areas immediately South of the stream footpath within Plots 8/27, 33 and 36; through which can traverse by horizontal direct drilling the electrical lines of Eastern Power Networks plc (as the sole licensed distributor) simultaneously. This micro-siting gateway ensures that the law relating to compulsory purchase and relevant guidance are complied with

and the continuation of the safe functioning of ARU Writtle Educational Establishment (“the Eastern Power Networks plc Micro-Siting Below Ground Gateway Provision”).

59. The dDCO provides for works inside the Envelope by “UKPN”. “UKPN” includes only one person licensed to distribute electricity and so entitled under Article 3 to operate and use distribution electrical lines: Eastern Power Networks plc. Therefore, this protective provision relates to that entity.
60. The Envelope would overlap land in the Northern extent of ARU Writtle land adjacent to a stream. The envisaged works would rely on Schedule 1 to the dDCO and its “associated development” descriptions.
61. The sworn evidence of ARU Writtle describes that: a) below ground electrical lines can result in microshocks if the cables are close to the ground surface, and with resulting startling of horses and consequent real risk of injury and harm such horses, as resulting significant risk of injury and harm to students (including children, other students and staff); and b) disturbed ground surfaces result in real risks to horses of injury, harm and sometimes death.
62. Further, the evidence of “UKPN” to the CAH Issue Specific Hearing on 24th June 2026 as that it did not know at the date whether or not compulsory acquisition powers were required by it in relation to over 200 hundred parties. It is evident that NGET and the ExA cannot be in a better position than “UKPN” itself. Applying *Prest*, it cannot be said by NGET, by the ExA, nor by the SoS, that the land is actually required by “UKPN” to be compulsorily acquired nor that public interest “decisively so demands” the taking of the land of those hundreds of parties against their will, including the land of ARU Writtle. It follows that section 122(2) and (3) cannot be satisfied as at Deadline 6 (7th July 2026) during the statutory 6 month examination period.
63. Furthermore, the inclusion by NGET in its dDCO of Part V powers in favour of “UKPN” was and remains fundamentally misconceived and in breach of the requirement of Parliament in paragraph 2.6.3 of NPS EN-3 (2023). Thereby, to include Part V powers in favour of UKPN would be in breach of section 104(3) of the PA 2008 because NGET included those powers as a “first resort” and not as a “last resort”.
64. (Subject to refinement of the terms by the ExA), the terms of the Protective Provision are:

For the protection of ARU Writtle, Part V of the development consent order cannot apply to the extent of Fields 8, Park 1 and Park 2 (identified as Plot 8/27 and Plot 8/33 and Plot 8/36).

Eastern Power Networks plc may below a depth of 1m beneath the ground surface level of the said Plots install and keep an electrical distribution line inside of the Order Limits as they relate to ARU Writtle, unless otherwise agreed in writing by ARU Writtle.

65. The outcome of that Protective Provision would be facilitate the installation of an electrical distribution line inside of the Order Limits by Eastern Power Networks plc with the agreement of ARU Writtle notwithstanding that Eastern Power Networks plc would as a result of the fundamental flaw by NGET lacks lawful powers of compulsory purchase. At the same time, the safe functioning of ARU Writtle could continue.
66. The basis of the foregoing provision is different to that in relation to NGET set out above and is set out below.
67. The dDCO includes proposed associated development in the paddock areas in the Northern part of the ARU land by UKPN. The dDCO includes in Part V powers of compulsory acquisition asserted by NGET to satisfy sections 122(2)(a)-(b) and (3) of the PA 2008. Further, the said development is asserted by NGET to be 'operated and used' by two parties that comprise "UKPN" of which only one is authorized by OfGem to distribute electricity under the Electricity Act 1989. As the ExA will know, the unauthorized distribution of electricity remains a strict liability offence under section 4(1)(bb) of that Act.
68. In fundamental legal error and in breach of paragraph 2.6.3 of NPS EN-5 (2023) and section 104(3) of the PA 2008 – as ought to be known to NGET - NGET has unlawfully included as a "first" resort powers as part of its application on the 29th August 2025 by which "UKPN" may compulsory acquired land of numerous parties including ARU. This was despite NGET appearing to actually know at 29th August 2025 that "UKPN" had not itself reached a concluded view on the need by its for such powers, and that "UKPN" itself affirmed on 24th June 2026 that it did not at that date have a concluded view.
69. The fundamental legal and guidance flaw by NGET is surprising and is regrettable.
70. The correct interpretation and meaning of an NPS is a question of law. See *R(on the application of Save Stonehenge World Heritage Site Limited) v Secretary of State for Transport* [2021] EWHC 2161 (Admin), at Appendix 1, paragraph 1(f), applying *Tesco Stores Ltd. v Dundee City Council* [2012] UKSC 13: "Statements of policy are to be interpreted objectively in accordance with the language used, read in its proper context." Thereby, "If there is a dispute about the meaning of the words included in a policy document which a planning authority is bound to take into account, it is of course for the court to determine as a matter of law what the words are capable of meaning. If the decision maker attaches a meaning to the words they are not properly

capable of bearing, then it will have made an error of law, and it will have failed properly to understand the policy.” See Tesco v Dundee.

71. By section 5 and 9 of the PA 2008, Parliament has affirmed the designation by the SoS of NPS EN-3 that contains a presumption in favour of the Scheme and NPS EN-5 (2023) (and (2025) that provides for compulsory acquisition of land rights and their inclusion as part of an application only as a “last resort” and not (as here, by NGET, as some kind of ‘insurance’).

72. By paragraph 2.6.3 of NPS EN-5 (2023):

2.6.3 As a last resort, where it does not succeed in reaching the agreement that it requires, the network company may, as part of its application to the Secretary of State, seek to acquire rights compulsorily over the land in question by means of a provision in the DCO.

73. The Shorter Oxford English Dictionary (the Edition) defines the ordinary meaning of “last resort” to mean: “as a final expedient; when all else has failed; ultimately”; and “final” to mean “conclusive”; “marking the last stage of a process”; and “last” to mean: after all others in a series, at the end”.

74. On its face, paragraph 2.6.3 connotes a process that must be concluded in advance of the inclusion in the “application” of provisions for compulsory acquisition of rights over the land of others.

75. But, NGET has ‘jumped the gun’ (again) and included in its dDCO “*as part of its application*” powers under Part V, Acquisition and Possession of Land “, *seek to acquire rights compulsorily over the land in question by means of a provision in the DCO*” including land of ARU.

76. There remains no evidence that NGET before 29th August 2025 failed to conclude terms with ARU in respect of oversailing with electric cables any part of ARU land.

77. Further, NGET has included in its dDCO “*as part of its application*” powers under Part V, Acquisition and Possession of Land, by which for a third party - “UKPN” - “*seek[s] to acquire rights compulsorily over the land in question by means of a provision in the DCO*”, including land of ARU.

78. There remains no evidence that “UKPN” before 29th August 2025 failed to conclude terms with ARU in respect of traversing with electric cables any part of ARU land.

79. In fact:

- a) for the first time at CAH 2, NGET disclosed to the ExA (and to the SoS) that its “Negotiations Tracker” document related exclusively to NGET and was not actually related to UKPN. This then disclosure took the ExA by surprise;
- b) for the first time on the 24th June 2026, “UKPN” described that it was not before November 2025 that “UKPN” and NGET agreed terms of a design development agreement and that it was subsequent to that agreement that “UKPN” then and only then itself approached from late March 2026 onwards the hundreds of landowners and occupiers in relation to the land of whom UKPN desired to carry out works;
- c) at CAH 2, NGET failed to disclose to the ExA that it had included on the 29th August 2025 Part V powers in its dDCO seeking compulsory acquisition of land simultaneously in the actual knowledge that it had not yet agreed with UKPN a design development agreement and so NGET can only have that on the 29th August 2025 its inclusion of Part V powers in relation to UKPN was a “first resort” and cannot have been a “last resort”;
- d) at CAH 3, “UKPN” affirmed on the 24th June 2026 that it itself did not at that date then actually know whether or not it needed compulsory purchase powers in relation to any of the hundreds of landowners and occupiers because at 24th June 2026 it was only at the start of its own process in respect of works;
- e) as at 29th August 2025, NGET cannot have been in a better position on the facts than “UKPN” to know whether or not “UKPN” itself needed compulsory purchase powers in relation to any of the hundreds of landowners and occupiers, and at that date, “UKPN” had no idea whether or not it needed such powers, and, as at 24th June 2026, “UKPN” candidly affirmed that it still had no idea whether or not it needed such powers;
- f) as at 24th June 2026, neither NGET nor the ExA can be in a better position than “UKPN” itself to whether or not “UKPN” needs Part V powers boldly asserted by NGET (in August 2025) as actually “required” by UKPN. Nor can the SoS be in a better position at this date than “UKPN”.

80. (Since 29th August 2025) NGET remains not entitled to make paragraph 2.6.3 mean what it desires that paragraph to mean because NGET does not live in the land of Humpty Dumpty. See *Tesco v Dundee*; applied

to the PA 2008 in *Stonehenge*. “Last resort” says “last resort” and “last resort” cannot mean “first resort”. Only Humpy Dumpty can make “last resort” say “first resort”.

81. Further, “[t]he [SoS as] author of a planning policy is not free to interpret the policy so as to give it whatever meaning he might choose in a particular case. The interpretation of planning policy is, in the end, a matter for the court (see paragraph 18 of Lord Reed's judgment in *Tesco v Dundee City Council*).” See *Tesco v Dundee*; applied to the PA 2008 in *Stonehenge*. “Last resort” says “last resort” and “last resort” cannot mean “first resort”. In law, the SoS is not free to interpret “last” resort as “first” resort.

82. It remains no answer (if NGET may do the same) to assert that section 104(2)(a) requires some kind of ‘balance’ to be struck between NPS EN-3 and EN-5 because it does not. Rather, section 104(3) requires adherence to the relevant NPS and NPS EN-5 (2023) requires a process to have been followed and concluded before the inclusion of acquisition powers in an application for a DCO “as a last resort”.

83. In particular:

- a) the clear words of paragraph 2.6.3 of EN-5 expressly supply an actual circumstance comprised of a “process” (“last resort”) that chronologically actually precedes (“where”) the actual making of an application and is only concluded when that process “fails”;
- b) the clear words of paragraph 2.6.3 denote a condition precedent to the making of an application that includes “as part of its application” any provisions seeking compulsory rights: “As a last resort, where it does not succeed in reaching the agreement that it requires, the network company may, as part of its application to the Secretary of State, seek to acquire rights compulsorily over the land in question by means of a provision in the DCO”;
- c) section 104(3) requires: “The Secretary of State must decide the application in accordance with any relevant national policy statement”. Because the clear words of paragraph 2.6.3 denote a process that chronologically precedes the making of an application for a development consent order, there is no ‘balance’ falling to be struck. Instead, there remains a process required to be followed;

84. The express subjugation by Parliament of section 120(3)-(6) to the provisions of section 122 shows the clear and unambiguous intention of Parliament to protect the landowner and occupiers from the draconian measure of compulsory acquisition. See the *Chilton* case.

85. The affirmation by Parliament by means of sections 5 and 9 of the PA 2008 of NPS EN-5 (2023) (and 2025) to include paragraph 2.6.3 evidences the express intention of Parliament to include paragraph 2.6.3 as a necessary protection for landowners and occupiers against the draconian measure of compulsory acquisition of their land, in the particular context where its similarly affirmed NPS EN-3 (2023) engenders a presumption in favour of the authorized development part of the Scheme, and in the statutory context of section 120(7) by which section 120(3)-(6) is expressly subject to section 122 and its compulsory purchase provisions set out above.
86. What is the mischief that Parliament ensured would be protected by its drafting of section 104(3), 120(7) and paragraph 2.6.3 of NPS EN-5 (2023) (and 2025)? That is, because NGET could at some stage resort to seeking powers of acquisition under section 122 in any event for both it and “UKPN”? It remains clear that the mischief was to preserve the status quo of: a period of time coupled with a process during the whole of which the landowner or occupier was free to negotiate terms with NGET (and separately with UKPN) without the particular threat of compulsion of acquisition of his land, simultaneously with NGET itself and UKPN itself each being free to negotiate terms with each landowner and occupier without yet having applied for a development consent order that included as part of its application compulsory powers of land acquisition. That circumstance is very different to the situation in which a landowner or occupier may find themselves after the event of a particular application being made that includes the seeking of powers to acquire their land compulsorily when then negotiating with NGET (and with UKPN) – the balance of risk has then fundamentally changed, and the landowner or occupier is then required by the Infrastructure Planning (Interested Parties) Regulations 2010 to also formally object to the taking of his land and thereby is exposed to increased financial risk and potentially significant costs.
87. It follows that NGET has placed the ExA (and SoS) in a position where the SoS would necessarily breach the requirement of paragraph 2.6.3 in the discharge of his statutory obligation under section 104(3) – if the application for a development consent order included the powers under Part V in respect of “UKPN”. Conversely, the ongoing inclusion of Part V powers in respect of “UKPN” would result to breach section 104(3) because (as NGET well knows or ought to well know) “UKPN” could not know on the 29th August 2025 whether or not it needed Part V powers, let alone whether they were included at the date when they were included “as part of the application” as a “last resort”.
88. NGET’s fundamental legal error is regrettable. So too remains its lack of candour up to CAH 2 in respect of the evidence of the “Negotiations Tracker” that resulted in the ExA inadvertently assuming that asserted evidence

related to both NGET and UKPN – but that “Tracker” never has related to “UKPN”. There remains no evidence at all from “UKPN” that it began nor concluded any negotiations with hundreds of third party landowners before 29th August 2025.

89. On the actual evidence of “UKPN” itself, on and from the 24th June 2026, the common law of *Prest* requires in respect of that fact:

- a) the ExA to recommend exclusion of the Part V powers of the dDCO in relation to each and every one of the hundreds of landowners and occupiers to which those powers relate in respect of “UKPN” works because section 122(2)(a) and (b) cannot be satisfied in respect of “UKPN”;
- b) the ExA to recommend that the “public interest” test of section 122(3) is evidenced in favour of the landowners and occupiers envisaged to be subject to Part V powers of the dDCO because Parliament’s NPS EN-5 (2023) test cannot be satisfied here as it cannot be said that the Part V powers were included as a “last resort but instead were included by NGET (unlawfully) as a “first resort” and of which NGET was well aware or ought to have been aware;
- c) the SoS in law is not entitled to grant the application including Part V powers in relation to each and every one of the hundreds of landowners and occupiers to which those powers relate in respect of “UKPN” works because section 122(2)(a) and (b) cannot be satisfied in respect of “UKPN”. Instead, the common law requires him to exclude those powers in respect of “UKPN”;
- d) the SoS in law is not entitled to grant the application including Part V powers in relation to each and every one of the hundreds of landowners and occupiers to which those powers relate in respect of “UKPN” works because section 122(3) cannot be satisfied in respect of “UKPN”. This is because the “public interest” test of section 122(3) evidenced by paragraph 2.6.3 of NPS EN-5 (2023) operates in favour of the landowners and occupiers envisaged to be subject to Part V powers of the dDCO. Here, Parliament’s NPS EN-5 (2023) test cannot be satisfied here as it cannot be said that the Part V powers were included as a “last resort but instead were included by NGET (unlawfully) as a “first resort” and of which NGET was well aware or ought to have been aware.

90. Further, as paragraph 16 of the 2013 CPO Guidance makes clear, and the evidence of UKPN on the 24th June 202 itself supports to ensure a lawful and rational decision: (Emphasis added)

16. *There may be circumstances where the Secretary of State could reasonably justify granting development consent for a project, but decide against including in an order the provisions authorising the compulsory acquisition of the land.*

91. Helpfully, section 120(7) makes clear that the provisions of section 120(3)-(6) are “subject to” section 122. Within section 120(3)-(6), under sections 120(3) and (4), “the provision that may be made under subsection (3) includes in particular provision for or relating to any of the matters listed in Part 1 of Schedule 5.” Paragraph 10 of that Part of that Schedule provides for the provision: “*The protection of the property or interests of any person.*”
92. On its correct construction in the sphere of compulsory purchase, and in particular, under section 122, the lawful scope of paragraph 10 is not confined (as NGET may assert) exclusively to “statutory undertakers” or “regulators”. Indeed, such a phrase or words do not appear on the face of paragraph 10.
93. ARU comprises a number of such “persons” and its persons have an interest in the land of ARU asserted by NGET as justified (on the 29th August 2025 and to date at 7th July 2026) as able to be compulsorily acquired by “UKPN”.
94. The *Sainsbury’s* and *Chilton* cases have been referred to above. Applying its presumption to the construction of section 120(4) in the context of section 120(7) and 122, the common law bears on the open ended power of those sections to ensure that the ExA recommend (and the SoS decides) to include a paragraph 10 protective provision on terms that precludes the application of Part V of the dDCO by “UKPN” to each of the landowners and occupiers referred to in the Book of Reference, including ARU and its interests in its land.
95. Would this result to prohibit the authorized development from proceeding? No, it could not.
96. Section 153 of the PA 2008, and Schedule 6, paragraphs 3(1) and following, expressly provide for the change by the SoS, on an application to him, of the terms of a relevant development consent order. In the event that terms could not be agreed by each particular landowner or occupier between each and “UKPN”, then “UKPN” or NGET could apply in respect of that particular landowner or occupier and the respective interest to the SoS to remove the protective provision from the order (if consented) on the basis that, at that later date, the requirement of paragraph 2.6.3 of NPS EN-3 (2023) was then met, the particular parties had then failed to agree terms, and so it could be lawfully said that the proposed change to include the application of Part V powers under that order was then being used as a lawful “last resort”.

97. In this way, the requirement that compulsory acquisition remain a remedy of “last” and not “first” resort, as Parliament intended, is ensured and the parties placed in a position so far as the law will allow that reflects the requirement of paragraph 2.6.3 of NPS EN-3 (2023).
98. Would that application process result to prohibit the authorized development from proceeding? No, it could not.
99. NGET has expressly sought powers for an authorized development: a) in the form of a “*Rochdale Envelope*”; and b) comprised of numerous individual segments or series of segments (of discrete freestanding pylons with cables between each) that, when constructed together, ultimately would comprise a single overhead line between numerous individual pylons but could not until that point be a single line. The form of the authorized development expressly ensures that no detailed content of the interior of the Envelope is before the ExA or SoS in evidence at this Deadline 6 nor can be known. The particular segmented nature of the authorized development ensures that no single particular person could impede progression of the authorized development because the construction of other segments can progress whilst negotiations in line with paragraph 2.6.3 and the common law proceed.
100. What about “UKPN” itself? Article 2(1) defines “UKPN” to comprise not one but two legal entities. Article 3 of the dDCO includes references to “UKPN”.
101. In particular, Article 3(5) provides: (Emphasis added)
- 5) *UKPN may operate and use the electric line and any other elements of the UKPN Works as part of the electricity distribution network.*
102. However, section 4 of the Electricity Act 1989 prohibits the following:
- 1) *A person who – a) generates electricity for the purpose of giving a supply to any premises or enabling a supply to be so given ... bb) distributes electricity for that purpose; ... shall be guilty of an offence unless he is authorised to do so by a licence.*
103. Article 2(1) of the dDCO expressly defines “UKPN” to include two entities:
- a) UK Power Networks Holdings Limited (registered company number 07290590);
- b) Eastern Power Networks plc (registered company number 02366906).

104. OfGem may grant a licence under section 6 of that Act but has granted a distribution licence only to Eastern Power Networks plc (registered company number 02366906). No such licence has been granted by OfGem.
105. On its face, it is difficult to see how the ExA could recommend the authorization of a criminal offence, nor how the SoS could himself consent the actual operation and use of the distribution lines by UK Power Networks Holdings Limited when during the Examination Period and today that would remain a criminal offence.
106. Further, NGET asserts in its Funding Statement (that forms part of its Compulsory Acquisition evidence) its reliance on funding from OfGem. It cannot be said that OfGem would have no concerns about the foregoing offence and the financial inter-relationship between the two entities of “UKPN” in the same dDCO.
107. It follows that the removal of the application of Part V as referred to above would enable “UKPN” to resolve the situation that NGET has drafted in the NGET dDCO and potentially change the terms of the order (if consented) to ensure that no criminal offence is commissioned by an unlicensed party in respect of the operation and use of the distribution network.

C. The Scaffolding Provision

108. The Envelope referred to above would include the potential for NGET to situate scaffolding structures on ARU Writtle land adjacent to the highway of Newney Green Lane. See Document 6.4.F1, Figure 4.1, Project Description, of the Environmental Statement, yellow colouration, and the NGET Written Response to ARU Writtle.
109. In that Response, and in meetings with NGET, NGET has indicated to ARU that it envisages the scaffolding *in situ* to protect users of the highway during the period when NGET is installing overhead cables between pylon references TB 166 and TB 165.
110. NGET has also evidenced that the period of its cable installation would be some 4 hours.
111. NGET has sought in Article 49(1)(b) of its dDCO powers to “prohibit use” of highways identified on the Traffic Regulation Order Plans. Section F, Sheet 8 of those Plans identifies in blue line the extent of Newney Green Lane adjacent to the Western edge of ARU Writtle land.
112. Article 49(2) affirms the powers under Article 49(1) to be “specific” and not limited by (2). Indeed, Article 49(2) confirms the provisions of Article 49(2) presuppose the specific powers under (1). That is, no consent is

required on the face of the dDCO for NGET to execute its Article 49(1)(b) closure of “use” of a given highway or for a period that NGET needs.

113. Therefore, as the ExA has properly recognised, the presence of Article 49(1)(b) evidences that there is no actual need for the scaffolding proposed by NGT to be situated on ARU land to protect “users” of the same road that NGET is empowered to close for “use”.

114. Having regard to the case law referred to above, in particular the *Prest* case, the ExA is required to resolve the evidence of Article 49(1)(b) and the related Traffic Regulation Order Plans. Section F, Sheet 8, in favour of ARU. The result of that is that there is no actual need for Plots 8/29 or Plot 8/37 or Plot 8/38 to sustain scaffolding. It follows that section 122(2)(a) and (b) cannot be satisfied.

115. Further, ARU has submitted sworn evidence in its submissions, and most recently from Caroline Flanagan demonstrating the real functional impediment to ongoing operation of paddock areas whose ground level surface is both compressed by scaffolding and reinstates in some way, and to the real risk to horses traversing the paddocks where the aforementioned Figure 4.1 illustrates scaffolding would be situated. The public interest in the maintenance of ARU as a national Educational Establishment is also of significant weight. Consequently, it cannot be said that there is a compelling case to erect scaffolding for a period of 12 weeks or so merely to provide for 4 hours of working to install overhead cables over a highway that can be closed under the specific power of Article 49(1)(b) at NGET’s behest.

116. The ExA is also referred to the technical evidence of the Technical Note Mr Joe Hough of KMC Transport Planning.

117. (Subject to refinement of the terms by the ExA), the terms of the Protective Provision are:

For the protection of ARU Writtle, in relation to the construction of Works No.17, Part V of the development consent order cannot apply to the extent of Fields 4, 5, 6 and 7 (identified as Plot 8/29, Plot 8/37 and Plot 8/38).

118. The outcome of that Protective Provision would be to preclude the situation of scaffolding on the land immediately East of Newney Green Lane highway and so protect the paddock surface areas from being compressed by scaffolding resting on that surface and for an extended period. This provision would ensure the ongoing safe functioning of ARU Writtle as an Educational Establishment and prevent risk of real injury

and harm to horses in the herd of the Facility as a result of such ground surface compression and reinstatement.

119. A similar outcome could be ensured by the imposition of a similarly worded Requirement.

D.The ARU Safe Crossing Provision

120. ARU refers the ExA and SoS to the submitted sworn evidence in its submissions, in particular the evidence of Mr Daniel Cook, and to the technical expert evidence of the technical evidence of the Technical Note Mr Joe Hough of KMC Transport Planning.

121. ARU has evidenced that its Facility comprises two halves on each side of Cow Watering Lane highway, and that there are daily regular crossings of that highway at the particular point evidenced on the submitted plan where students (including children) cross and recross with horses and teachers.

122. The dDCO of NGET includes provisions entitling NGET to divert traffic along Cow Watering Lane highway. The introduction of traffic on diversion and unfamiliar with the Lane, and of construction-related traffic, would result to increase the real risk of traffic accidents between vehicles and animals and between vehicles and people.

123. The proposed Outline Construction Traffic Management Plan includes no provisions nor express terms ensuring the foregoing risks are avoided, in particular because the Lane is not a “PAR” to which particular safeguards apply. Nor is there a provision or requirement ensuring the safe crossing of the Lane on clear terms.

124. The reliance by NGET on future decision makers acting competently was rejected and overtaken over two decades ago by the Court of Appeal in the case of *Smith v Secretary of State for the Environment, Transport and the Regions* [2003] Env LR 32, at paragraph 33: (Emphasis added)

33. In my view it is a further important principle that when consideration is being given to the impact on the environment in the context of a planning decision, it is permissible for the decision maker to contemplate the likely decisions that others will take in relation to details where those others have the interests of the environment as one of their objectives. The decision maker is not however entitled to leave the assessment of likely impact to a future occasion simply because he contemplates that the future decision maker will act competently. Constraints must be placed on the planning permission within which future details can be worked out, and the decision maker must form a view about the likely details and their impact on the environment.

125. *“Constraints must be placed on the planning permission within which future details can be worked out, and the decision maker must form a view about the likely details and their impact on the environment.”* In this matter, the “constraints” are the requirements set out in the evidence of Mr Hough by which the safe crossing and recrossing of the Lane can be ensured, and the ongoing function of ARU Writtle be safeguarded.

126. The terms of the protective provision for the benefit of ARU Writtle is:

For the protection of ARU Writtle, no diversion of traffic along Cow Watering Lane can occur without suitable traffic safety measures being agreed with Essex County Council and carried out by the Applicant.

127. A similar outcome could be ensured by the imposition of a similarly worded Requirement.

APPENDIX B

FACTS

Background Facts

128. ARU Writtle is an educational establishment situated to the West of Writtle on each side of the western end of Cow Watering Lane, and to the East of Newney Green Lane highway. The facts relating to the situation, operation and functioning of ARU has been referred to in previous Written Submissions and supporting sworn evidence. The reader is directed respectfully to those previous Submissions and that supporting evidence.

Recent Facts

129. Accompanying this Deadline 6 Written Submission are the sworn witness statements of, and on behalf of, ARU that evidence the facts. The reader is directed respectfully to that supporting evidence.

National Guidance: Planning Act 2008 – Guidance related to procedures for the compulsory acquisition of land (September 2013)

130. The Secretary of State's Guidance: "Planning Act 2008 – Guidance related to procedures for the compulsory acquisition of land (September 2013)" ("the 2013 CPO Guidance") provides for the use of section 122 Planning Act 2008 powers includes as follows: (Emphasis added)

7. Applicants must therefore be prepared to justify their proposals for the compulsory acquisition of any land to the satisfaction of the Secretary of State. They will also need to be ready to defend such proposals throughout the examination of the application. Paragraphs 8-19 below set out some of the factors which the Secretary of State will have regard to in deciding whether or not to include a provision authorising the compulsory acquisition of land in a development consent order.

General Considerations

8. The applicant should be able to demonstrate to the satisfaction of the Secretary of State that all reasonable alternatives to compulsory acquisition (including modifications to the scheme) have been explored. The applicant will also need to demonstrate that the proposed interference with the rights of those with an interest in the land is for a legitimate purpose, and that it is necessary and proportionate.

9. The applicant must have a clear idea of how they intend to use the land which it is proposed to acquire...

The purpose for which compulsory acquisition is sought

11. Section 122 of the Planning Act sets out two conditions which must be met to the satisfaction of the Secretary of State before compulsory acquisition can be authorised. The first of these is related to the purpose for which compulsory acquisition is sought. These three purposes are set out in section 122(2):

(i) the land is required for the development to which the development consent relates

For this to be met, the applicant should be able to demonstrate to the satisfaction of the Secretary of State that the land in question is needed for the development for which consent is sought. The Secretary of State will need to be satisfied that the land to be acquired is no more than is reasonably required for the purposes of the development...

Compelling case in the public interest

12. In addition to establishing the purpose for which compulsory acquisition is sought, section 122 requires the Secretary of State to be satisfied that there is a compelling case in the public interest for the land to be acquired compulsorily.

13. For this condition to be met, the Secretary of State will need to be persuaded that there is compelling evidence that the public benefits that would be derived from the compulsory acquisition will outweigh the private loss that would be suffered by those whose land is to be acquired. Parliament has always taken the view that land should only be taken compulsorily where there is clear evidence that the public benefit will outweigh the private loss.

Balancing public interest against private loss

14. In determining where the balance of public interest lies, the Secretary of State will weigh up the public benefits that a scheme will bring against any private loss to those affected by compulsory acquisition...

16. There may be circumstances where the Secretary of State could reasonably justify granting development consent for a project, but decide against including in an order the provisions authorising the compulsory acquisition of the land. For example, this could arise where the Secretary of State is not persuaded that all of the land which the applicant wishes to acquire compulsorily has been shown to be necessary for the purposes of the scheme. ... Such scenarios could lead to a decision to remove all or some of the proposed compulsory acquisition provisions from a development consent order....

Pre-application

20. A development consent order may only contain a provision authorising compulsory acquisition if one of the conditions set out in section 123(2)–(4) are met...

Consultation

...

25. Applicants should seek to acquire land by negotiation wherever practicable. As a general rule, authority to acquire land compulsorily should only be sought as part of an order granting development consent if attempts to acquire by agreement fail.

National Guidance: Power Lines: Control of Microshocks and other indirect effects of public exposure to electric fields: A voluntary Code of Practice (July 2013)

131. In July 2013, the Department of Energy and Climate Change published guidance entitled “Power Lines: Control of Microshocks and other indirect effects of public exposure to electric fields: A voluntary Code of Practice (July 2013)” (“the Code”). The Code includes as follows:

Microshocks can occur whenever a person and a conducting object almost touch under a power line and are not (by virtue of being connected to each other or both being connected to earth) at the same potential. The conducting object can be anything, and either the person or the object can be at a floating potential. In practice, experience has identified several common scenarios:

- ...
-
- person riding, leading, or touching horse or other animal ...

As well as the actual physical sensation of the microshock, microshocks could in some circumstances give rise to further effects, either if the microshock causes a person to startle with dangerous consequences, or if repeated microshocks cause aversive responses to the situation that produces them...

Requirements for controlling microshocks

This Code of Practice recognises that there is no reasonable way to avoid microshocks in all circumstances, even in circumstances when they are at a frequency and severity that is clearly undesirable, and therefore that not all situations producing microshocks are expected to be remedied.

This Code of Practice also recognises that control of microshocks is not based on a simple quantitative limit. Rather, there is a suite of measures that may be called upon in particular situations.

*The simpler measures, **such as avoiding** creating new situations particularly prone to microshocks, provision of information, and earthing, where any of these are applicable, are to be preferred and adopted first... It is less likely that specific circumstances exist that would justify particularly extreme measures, such as raising clearances or re-routing of existing lines.*

Specifically:

- *Electricity companies will, where reasonably practicable, **avoid** designing new power lines that would create fields of 5 kVm-1 or greater in homes, other land in residential use, their curtilage, and schools*⁸
 - *Note that existing good line-routing practice will normally achieve this anyway by routing lines away from existing homes and schools. If a new line over a home, its curtilage, or a school is **unavoidable**, a field below 5 kV m-1 can be achieved by designing the line with an appropriate clearance. In the converse situation of new homes close to existing power lines, electricity companies will encourage sensitive design that avoids such situations, but no restrictions or controls are created by this Code of Practice...*
- *There is no requirement that clearances of existing overhead lines, or of new overhead lines except where they unavoidably pass over homes, other dwelling places, their curtilage, and schools, should be increased because of microshock issues, though this could be done voluntarily by electricity companies.*

132. Footnote 8 states:

The definition of the land affected is the same as that given in full in “Power Lines: Demonstrating compliance with EMF public exposure guidelines: A voluntary Code of Practice. Reissued March 2012”

133. The Shorter Oxford English Dictionary (the Edition) defines the meaning of the following words:

- a) “avoidable” to mean “able to be avoided”;
- b) “first” to mean “preceding all others in time, order, series, succession, etc; earliest in occurrence”;
- c) “inevitable” to mean “A thing which cannot be avoided”;
- d) “school” to mean “an establishment in which children are given formal education”, “an institution in which formal instruction in a specific skill or attribute is given; a course of instruction taking place at a specified time”; and
- e) “unavoidable” to mean: “not avoidable”, “inevitable”.

National Planning Policy Statements

NPS – EN1 (2023)

134. The applicable NPS remains EN1 (November 2023) and this included: (Emphasis added)

1.1.4 The Planning Act 2008 also requires that, where an NPS has effect, the Secretary of State must decide an application for energy infrastructure in accordance with the relevant NPSs except to the extent the Secretary of State is satisfied that to do so would:

- lead to the UK being in breach of its international obligations*
- be in breach of any statutory duty that applies to the Secretary of State*
- be unlawful*
- result in adverse impacts from the development outweighing the benefits*
- be contrary to regulations about how its decisions are to be taken...*

1.3.13 The Planning Act 2008 enables the Secretary of State to issue a Development Consent Order that can make provision relating to, or to matters ancillary to, the development of the energy infrastructure NSIP. This may include, for example, the authorisation of tree lopping and the compulsory acquisition of land or rights over land...

3.3.63 Subject to any legal requirements, the urgent need for CNP Infrastructure to achieving our energy objectives, together with the national security, economic, commercial, and net zero benefits, will in general outweigh any other residual impacts not capable of being addressed by application of the mitigation hierarchy...

4.1.3 Given the level and urgency of need for infrastructure of the types covered by the energy NPSs set out in Part 3 of this NPS, the Secretary of State will start with a presumption in favour of granting consent to applications for energy NSIPs. That presumption applies unless any more specific and relevant policies set out in the relevant NPSs clearly indicate that consent should be refused.

4.1.4 The presumption is also subject to the provisions of the Planning Act 2008 referred to at paragraph 1.1.4 of this NPS...

Secretary of State decision making

...

4.3.22 Given the level and urgency of need for new energy infrastructure, the Secretary of State should, subject to any relevant legal requirements...

4.3.26 As the Secretary of State must assess an application in accordance with the relevant NPS (subject to the exceptions set out in section 104 of the Planning Act 2008)...

NPS – EN5 (2023)

135. The applicable NPS remains EN5 (November 2023) and this included:

2.6.1 In order to be lawfully able to install, inspect, maintain, repair, adjust, alter, replace or remove an electricity line (above or below ground), its related equipment (such as monopoles, pylons/transmission towers, transformers and cables), and/or its associated mitigation or enhancement schemes, applicants must:

- i. own the land on, over, or under which the relevant activity is to take place; or*

- ii. *hold sufficient rights over or interests in that land (typically in the form of an easement); or*
- iii. *have permission for the activity from the present owner or occupier of that land (typically in the form of a wayleave)*^[footnote 11].

2.6.2 *Where the applicant does not own or wish to own the land in question, it should try to reach a voluntary agreement giving it sufficient rights and/or permissions to undertake the relevant work*^[footnote 12].

2.6.3 *As a **last resort**, **where** it does not succeed in reaching the agreement that it requires, the network company **may**, as **part of its application** to the Secretary of State, **seek to** acquire rights compulsorily over the land in question by means of a provision in the DCO.*

2.6.4 *In such cases (i.e. where the compulsory acquisition of rights is sought) permanent arrangements are strongly preferred over voluntary wayleaves ...*

2.6.6. ... *The Secretary of State will consider any **such application** under the provisions of the Planning Act 2008 and any associated guidance.*^[footnote 13]

136. The Shorter Oxford English Dictionary (the Edition) defines the meaning of the following words:

- a) “before” to mean “in front in place or order; at or on the front; earlier in time”;
- b) “final” to mean “conclusive”; “marking the last stage of a process”;
- c) “last” to mean: after all others in a series, at the end”; and
- d) “last resort” to mean: “as a final expedient; when all else has failed; ultimately”.

NPS – EN5 (2025)

137. The recent NPS EN-5 remains consistent with that of 2023. Section 2.6 Land Rights and Land Interests includes:

2.6.1 *In order to be lawfully able to install, inspect, maintain, repair, adjust, alter, replace or remove an electricity line (above or below ground), its related equipment (such as monopoles, pylons/transmission towers, transformers and cables), and/or its associated mitigation or enhancement schemes, applicants must:*

- *Own the land on, over, or under which the relevant activity is to take place; or*
- *Hold sufficient rights over or interests in that land (typically in the form of an easement); or*
- *Have permission for the activity from the present owner or occupier of that land (typically in the form of a wayleave).*

2.6.2 *Where the applicant does not own or wish to own the land in question, it should try to reach a voluntary agreement giving it sufficient rights and/or permissions to undertake the relevant work*^[footnote 12].

2.6.3 *As a **last resort**, **where** it does not succeed in reaching the agreement that it requires, the network company **may**, as **part of its application** to the Secretary of State, **seek to** acquire rights compulsorily over the land in question by means of a provision in the DCO.*

2.6.4 *In such cases (i.e. where the compulsory acquisition of rights is sought) permanent arrangements are strongly preferred over voluntary wayleaves ...*

2.6.5 *The applicant may also seek the compulsory acquisition of land. This will not normally be necessary where lines and cables are installed but may be sought where other forms of electricity networks infrastructure (such as new substations) are required...*

The draft Development Consent Order

138. The draft Development Consent Order includes and evidences as follows.

139. Under draft Article 2: (Emphasis added)

1) *In this Order, unless the context requires otherwise— ...*

“UKPN” means UK Power Networks Holdings Limited (registered company number 07290590) and/or its affiliate Eastern Power Networks plc (registered company number 02366906);

“UKPN Works” means those works to UKPN assets or equipment forming part of the authorised development, including Work Nos. 25 to 36; ...

“Undertaker” -

a) in relation to the authorised development, means National Grid; and

b) in relation to the UKPN Works and subject to paragraph (5) of article 6 (benefit of Order), includes UKPN; ...

140. Draft Article 3 includes: (Emphasis added)

1) Subject to the provisions of this Order (including the Requirements) National Grid is granted development consent for the authorised development set out in Schedule 1 (authorised development).

2) National Grid may—

a) install and keep installed the authorised development;

b) remove or replace any electric line including pylons or poles that may require removal as part of the authorised development.

3) UKPN may—

a) Subject to paragraphs (3), (4) and (5) of article 6 (benefit of Order) carry out the UKPN Works; and

b) remove or replace any electric line including pylons or poles that may require removal in relation to the UKPN Works.

4) National Grid may operate and use the authorised development (excluding the UKPN Works) as part of the high-voltage electricity transmission system in England and Wales.

*5) **UKPN may operate and use the electric line and any other elements of the UKPN Works as part of the electricity distribution network...***

141. Under draft Article 24, *Compulsory acquisition of land*, includes: (Emphasis added)

1) National Grid may acquire compulsorily so much of the Order land described in the book of reference as is required for the construction, operation and maintenance of the authorised development (including the UKPN Works) or is incidental to it or required to facilitate it.

2) UKPN may acquire compulsorily so much of the Order land described in the book of reference as is required for the construction, operation and maintenance of the UKPN Works only.

142. Draft Articles 27 and 28 provide for NGET and UKPN, respectively.

143. Draft Article 49 includes:

- 1) *Subject to the provisions of this article, the undertaker may at any time for the purposes of the authorised development or for purposes ancillary to the construction or maintenance of the authorised development—*
 - a) *prohibit waiting of vehicles and regulate vehicular speed by imposing a speed restriction on vehicles in the manner specified in Part 1 of Schedule 13 (traffic regulation orders) on a road specified in column (1) and along the lengths and between the points specified in column (2) in the manner specified in column (3) of that Part of that Schedule;*
 - b) *prohibit use of roads by through traffic and/or regulate the direction of vehicular movements in the manner specified in Part 2 of Schedule 13 (traffic regulation orders) on the roads specified in column (1) and along the lengths and between the points specified in column (2) in the manner specified in column (3) of that Part of that Schedule; ...*
- 2) *Without limiting the scope of the specific powers conferred by paragraph (1) but subject to the provisions of this article and the consent of the traffic authority in whose area the road concerned is situated, which consent must not be unreasonably withheld or delayed, the undertaker may, in so far as may be expedient or necessary for the purposes of or in connection with construction or maintenance of the authorised development, or for purposes ancillary to it, at any time—*
 - a) *revoke, amend or suspend in whole or in part any order made, or having effect as if made, under the 1984 Act;*
 - b) *...*
 - c) *...*
 - d) *...*
 - e) *permit, prohibit or restrict vehicular access to any road,*

either at all times or at times, on days or during such periods as may be specified by the undertaker...

144. Draft Article 60 includes:

- 1) *National Grid must, as soon as practicable after the making of this Order, submit to the Secretary of State copies of the plans and documents identified in Schedule 19 (certified documents) of this Order for certification as true copies of those plans and documents referred to in this Order.*
- 2) *A plan or document so certified is admissible in any proceedings as evidence of the contents of the document of which it is a copy ...*
- 3) *...*
- 4) *Where a plan or document certified under paragraph (1)—*
 - a) *refers to a provision in this Order (including any specified requirement) when it was in draft form; and*
 - b) *identifies the provision by number or combination of numbers and letters, which is different from the number or combination of numbers or letters by which the corresponding provision of this Order is identified in the Order as made;**the reference in the plan or document concerned must be construed for the purposes of the Order as referring to the provisions (if any) corresponding to that provision in the Order as made...*

145. Draft Schedule 1 of the draft Order includes the Works Nos. 1 – 40 and Associated Development.

A nationally significant infrastructure project as defined in sections 14 and 16 of the 2008 Act and associated development within the meaning of section 115(2) of the 2008 Act, comprising—

...

In the districts of Braintree District Council, Chelmsford City Council, Brentwood Borough Council, Basildon Borough Council and Thurrock Council

Work No. 17 — overhead transmission electric line (Route TB) from the Fairstead (Tilbury side) Cable Sealing End Compound to the Tilbury North Substation

Works shown as commencing on Section E Sheet 6 and terminating on Section H Sheet 5 of the works plans to construct and install a new overhead transmission electric line (Route TB) between the two gantries at the Fairstead (Tilbury side) Cable Sealing End Compound (Work No. 16) and the two gantries at the Tilbury North Substation (Work No. 18), including—

- a) the foundations and steelwork to construct new pylons;*
- b) the installation of 47 kilometres of overhead transmission electric line between the Fairstead (Tilbury side) Cable Sealing End Compound and the Tilbury North Substation;*
- c) the installation of conductors, insulators and fittings, including downleads and droppers at each gantry to facilitate connection to the equipment within the Fairstead (Tilbury side) Cable Sealing End Compound and the Tilbury North Substation; and*
- d) the installation of fibre optic conductors, with optical fibre terminated in joint boxes...*

Associated Development

Such associated development not listed above, within the Order limits, as may be necessary or expedient for the purposes of or in connection with the construction or maintenance of the above Work Nos. or any of them, including—

- a) ramps, means of access (including crossovers), footpaths, bridleways, trackways and pontoons; ...*
- f) works to alter the position of UKPN apparatus, including construction and installation, decommissioning and partial removal and alteration of electric line, conductors, cables and pylons; ...*
- i) tree, hedgerow and vegetation planting and maintenance works; ...*

146. Draft Schedule 19 identifies certified documents that includes Plans that includes: the Environmental Statement; Land Plans; Traffic regulation Order Plans, and Works Plans.

147. The land of ARU Writtle is identified in Section F, Sheet 8 of each of the foregoing Plans. The Works Plans identifies, by means of:

- a) a red outlined area, the extent of the land on which the authorized development can be constructed and maintained and currently at Deadline 6 (7th July 2026) includes an area of red outline that encompasses an area identified as “Plot 8/42” that bisects the Northern part of the ARU Writtle land;
- b) inside the red outlined area and that partly overlaps with the red line, an orange dashed line that identifies the “limits of deviation” inside the extent of land in (a) above;
- c) inside the extent of the orange dashed line a series of purple squares containing an “X” (but no more), the notional location of Pylons references TB166, TB165, TB164 and TB163;

- d) inside the extent of the orange dashed line a series of purple lines between each of the purple squares containing an “X” identifying (but no more) the notional location of the overhead cables between each of the notional location of Pylons references TB166, TB165, TB164 and TB163.

The Environmental Statement

148. Document 6.4, The Environmental Statement Chapter 4 - Project Description includes, and evidences, as follows: (Emphasis added)

4.1.5 ...[T]he Project comprises:

- *A new 400 kilovolt (kV) electricity transmission connection of approximately 180 km overall length from Norwich Main Substation to Tilbury Substation via Bramford Substation, a new EACN Substation and a new Tilbury North Substation, including:*
 - *Approximately 159 km of new overhead line supported on approximately 509 pylons, either standard steel lattice pylons (approximately 50 m in height) or low height steel lattice pylons (approximately 40 m in height) and some of which would be gantries (typically up to 15 m in height) within proposed Cable Sealing End (CSE) compounds or existing or proposed substations*
 - *...*
- *Up to seven new CSE compounds (with permanent access) to connect the overhead lines to the underground cables ...*

4.6 Application of a Rochdale Envelope and Design Scenarios

4.6.1 Advice Note Nine: Rochdale Envelope (Planning Inspectorate, 2025) provides guidance regarding the degree of flexibility that may be considered appropriate within an application for development consent under the Planning Act 2008. The advice note acknowledges that there may be parameters of a project’s design that are not yet fixed and, therefore, it may be necessary for the ES (Volume 6 of the DCO application) to assess likely worst-case variations to ensure that the likely significant environmental effects of the Project have been assessed.

4.6.2 Sufficient flexibility within the design is allowed to provide the future detailed design and build Main Works Contractor(s) with sufficient scope for ‘value engineering’ through innovative design and/or construction techniques and to respond to unknown information such as ground conditions. As such, the Project design presented in this ES (Volume 6 of the DCO application) and the accompanying assessment reflects the need for this flexibility and the requirements of Advice Note Nine: Rochdale Envelope (Planning Inspectorate, 2025) to ensure that the likely significant effects of the Project are assessed. Furthermore, the design has been informed by the EIA with the design reflecting iterative working between the designers and the environmental specialists.

4.6.3 The Order Limits include LoD, which represent the maximum locational flexibility for permanent features, such as the overhead line, pylons, underground cables, CSE compounds, the proposed new EACN Substation and the proposed new Tilbury North Substation.

4.6.4 The assessment of likely significant effects in this ES (Volume 6 of the DCO application) is based on the description of the design, construction, and operation (and maintenance) of the Project presented in this chapter and shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2). Consideration has also been given to the potential for variation in the description of individual components of the Project.

4.6.5 The environmental topic chapters consider sensitivity testing/flexibility in design that may be adopted to see if there would be new or different significant effects. Sensitivity testing/flexibility in design is assessed within Section 9 of each environmental topic chapter (Chapters 6 to 16 (documents references 6.6 to 6.16)) and includes:

- ...
- Flexibility in design:
 - Flexibility within the LoD, for example changes to the location or height of permanent features, such as pylons, within the LoD (other than where locations of pylons are committed to as detailed within the Outline CoCP (document reference 7.2))
 - Flexibility within Order Limits, for example there are elements of the Project where design flexibility has been identified.
 - ...

Overhead Line

4.8.42 The working areas around each new pylon would be cleared of vegetation and fenced appropriately. Access to each pylon location would be installed. Temporary appropriate technology / material would be required adjacent to each new pylon location, on which to place plant such as cranes and piling rigs. The stone working areas would typically be 60 m x 60 m (or 70 m x 70 m for angle/terminal/low-height suspension structures and 80 m x 80 m for low-height tension structures). Materials would be brought to site on HGVs and would include the steelwork for the pylons and the conductors (i.e. cabling) wrapped around large drums...

Vegetation Clearance for Overhead Lines

4.8.53 For the purposes of the ES (Volume 6 of the DCO application), a general approach has been assumed (unless otherwise stated) that where the Project interacts with woodland, trees and hedgerows, clearance would comprise the following approach for standard lattice pylons (refer to Image 4.9):

- Vegetation removed (to ground level or sufficient height to meet electrical clearances plus an allowance for growth)¹⁷: A 40 m wide swathe of vegetation removed to allow for the construction and operation (and maintenance) of the overhead line (to include all physical infringements to conductor, including conductor swing¹⁸ (45° blown-out conductor), i.e. 20 m either side of each overhead line centreline)
- Vegetation affected/managed: An additional up to 8 m of vegetation either side of the 40 m may then need be managed during construction and operation (and maintenance) to allow for electrical clearance from the conductor to be maintained (assumes a generalised allowance of 0.5 m growth per year over a five-year period)
- Vegetation potentially affected: A further up to 22 m of vegetation either side of the 8 m would be potentially affected, which includes allowances for design flexibility as per the proposed lateral LoD
- Vegetation unaffected: Vegetation beyond the 22 m would be unaffected...

The Statement of Reasons (May 2026) of NGET

149. The Statement of Reasons (August 2026) of NGET included Appendix A: “Details of Purpose for which Compulsory Acquisition and Temporary Possession Powers are Sought”:

1.1.2 The purpose(s) for which powers of compulsory acquisition and/or temporary possession are sought over each plot of land comprised within the Order land (being land shown on the 2.2 Land Plans ...

1.2.2 This Appendix is comprised of a number of tables, which reflect the nature of land use powers sought by National Grid (and UKOP and by UK Power Networks (UKPN) pursuant to the Class of Rights as shown in Table 1.1 below.

150. Table 1.1, “Land acquisition definitions and guidance” includes:

Colour of Plot on Land Plans	Land Use Power Sought	Principal Relevant DCO Article
Brown	Class 1 – Compulsory Acquisition of land	Article 24
Green	Class 2 – Compulsory Acquisition of rights: overhead line	Article 25
Orange	Class 3 – Compulsory Acquisition of rights: underground cable system	Article 25
Grey	Class 4 – Compulsory Acquisition of Rights: overhead line and underground cable system	Article 25
Uncoloured	Class 8 – Land not subject to powers of acquisition nor temporary use	N/A

151. More recently, the Statement of Reasons (May 2026) of NGET included Appendix A: “Details of Purpose for which Compulsory Acquisition and Temporary Possession Powers are Sought” reiterates the foregoing.

152. On the 24th June 2026, NGET affirmed to the ExA that it did not actually need Plot 8/42 and would remove the colour yellow from it so that it would then be classified as “Class 8” land.

APPENDIX C

LAW

Electricity Act 1989

153. The Electricity Act 1989 ("EA 1989") regulates the licensing, transmission and distribution of electricity as well as providing for compulsory purchase of land by a licensed party.

154. By section 3A:

- 1) *The principal objective of the Secretary of State and the Gas and Electricity Markets Authority (in this Act referred to as "the Authority") in carrying out their respective functions under this Part is to protect the interests of existing and future consumers in relation to electricity conveyed by distribution systems or transmission systems...*

155. By section 4, the EA 1898 prohibits a party who is not licensed from transmitting or distributing electricity as follows: (Emphasis added)

- 1) *A person who –
 - a) *generates electricity for the purpose of giving a supply to any premises or enabling a supply to be so given;*
 - b) *participates in the transmission of electricity for that purpose;*
 - bb) *distributes electricity for that purpose;*
 - c) *...*
 - d) *...*
 - e) *...*
 - f) *...**shall be guilty of an offence unless he is authorised to do so by a licence.**
- 2) *...*
- 3) *No proceedings shall be instituted in England and Wales in respect of an offence under this section except by or on behalf of the Secretary of State or the Authority; ...*
- 3A) *In subsection (1)(b) above, the reference to a person who participates in the transmission of electricity is to a person who—
 - b) *makes available for use for the purposes of a transmission system by means of which the transmission of electricity takes place anything which forms part of it...**
- 3B) *For the purposes of subsection (3A)(b), a person shall not be regarded as making something available just because he consents to its being made available by another...*
- 4) *In this Part, unless the context otherwise requires—
"distribute", in relation to electricity, means distribute by means of a distribution system, that is to say, a system which consists (wholly or mainly) of low voltage lines and electrical plant and is used for conveying electricity to any premises or to any other distribution system; ...
"transmission", in relation to electricity, means transmission by means of a transmission system;
"transmission system" means a system which—
 - a) *consists (wholly or mainly) of high voltage lines and electrical plant, and**

b) is used for conveying electricity from a generating station to a substation, from one generating station to another or from one substation to another.

5) *In this section— ...*

“system” means a system the whole or a part of which is at a relevant place; ...

156. By section 6:

1) *The Authority may grant any of the following licences—*

a) a licence authorising a person to generate electricity for the purpose of giving a supply to any premises or enabling a supply to be so given (“a generation licence”);

b) a licence authorising a person to participate in the transmission of electricity for that purpose (“a transmission licence”);

c) a licence authorising a person to distribute electricity for that purpose (“a distribution licence”);...

6) *A transmission licence may authorise the holder to participate in the transmission of electricity in any area, or only in an area specified in the licence....*

157. By section 10:

1) *Subject to subsection (2) below, Schedule 3 to this Act (which provides for the compulsory acquisition of land) and Schedule 4 to this Act (which confers other powers and makes other provision) shall have effect—*

a) in relation to the holder of a transmission licence or of an electricity system operator licence ; and

b) to the extent that his licence so provides, in relation to an electricity distributor or any other licence holder;

and references in those Schedules to a licence holder shall be construed accordingly.

2) *Where any provision of either of the Schedules mentioned in subsection (1) above is applied to a licence holder by his licence, it shall have effect subject to such restrictions, exceptions and conditions as may be included in the licence for the purpose of qualifying that provision as so applied or any power or right conferred by or under it...*

158. Within Schedule 3, paragraph 1 provides:

1) *Subject to paragraph 2 below, the Secretary of State may authorise a licence holder to purchase compulsorily any land required for any purpose connected with the carrying on of the activities which he is authorised by his licence to carry on.*

2) *In this paragraph and paragraph 2 below “land” includes any right over land (other than, in Scotland, a right to abstract, divert and use water); and the power of the Secretary of State under this paragraph includes power to authorise the acquisition of rights over land by creating new rights as well as acquiring existing ones.*

159. Paragraph 2 provides:

1) *No order shall be made under paragraph 1 above authorising the compulsory purchase of land belonging to another licence holder except with the consent of the Authority.*

2) *The Authority shall not give their consent under this paragraph if –*

- a) *the land is being used by the licence holder to whom it belongs for the purposes of an installation necessary for the carrying on of the activities which he is authorised by his licence to carry on; or*
- b) *it appears to the Authority that the land will be so used and that the use will commence, or any necessary planning permission or consent under section 36 or 37 of this Act will be applied for, within the period of five years beginning with the date of the application for his consent.*
- 3) ...
- 4) *A consent under this paragraph which is not acted on within the period of six months beginning with the day on which it is granted shall cease to have effect at the end of that period.*
- 5) *In this paragraph –
“the Planning Act” means the Town and Country Planning Act 1990 or the Town and Country Planning (Scotland) Act 1997
“planning permission” means a planning permission granted under Part III of the Planning Act.*

160. Paragraph 4 provides:

Where a licence holder has acquired any land by virtue of paragraph 1 above, he shall not dispose of that land or of any interest in or right over it except with the consent of the Authority.

Planning Act 2008

161. The Planning Act 2008 regulates the grant of development consent.

162. Within Part 2, by section 5:

- 1) *The Secretary of State may designate a statement as a national policy statement for the purposes of this Act if the statement—*
 - a) *is issued by the Secretary of State, and*
 - b) *sets out national policy in relation to one or more specified descriptions of development.*
- 2) *In this Act “national policy statement” means a statement designated under subsection (1) as a national policy statement for the purposes of this Act.*
- 3) *Before designating a statement as a national policy statement for the purposes of this Act the Secretary of State must carry out an appraisal of the sustainability of the policy set out in the statement.*
- 4) *A statement may be designated as a national policy statement for the purposes of this Act only if the consultation and publicity requirements set out in section 7, and the parliamentary requirements set out in section 9, have been complied with in relation to it and—*
 - a) *the consideration period for the statement has expired without the House of Commons resolving during that period that the statement should not be proceeded with, or*
 - b) *the statement has been approved by resolution of the House of Commons—*
 - i) *after being laid before Parliament under section 9(8), and*
 - ii) *before the end of the consideration period...*

163. By section 9, Parliamentary requirements:

- 1) *This section sets out the parliamentary requirements referred to in sections 5(4) and 6(7).*

- 2) *The Secretary of State must lay the proposal before Parliament.*
- 3) *In this section “the proposal” means—*
 - a) *the statement that the Secretary of State proposes to designate as a national policy statement for the purposes of this Act,*
 - b) *(as the case may be) the proposed amendment...*

164. Within Part 3, by section 14:

- 1) *In this Act “nationally significant infrastructure project” means a project which consists of any of the following—*
 - b) *the installation of an electric line above ground; ...*
- 2) *Subsection (1) is subject to sections 15 to 30A ...*

165. By section 16, a definition of “electric lines” is provided. In particular:

- 3) *The installation of an electric line above ground is not within section 14(1)(b)—*
 - a) *if the nominal voltage of the line is expected to be less than 132 kilovolts,*
 - aa) *if the length of the line (when installed) will be less than two kilometres,*
 - ab) *if*
 - i) *the line will replace an existing line,...*

166. Within Part 4, by section 31: (Emphasis added)

Consent under this Act (“development consent”) is required for development to the extent that the development is or forms part of a nationally significant infrastructure project.

167. By section 33:

- 1) *To the extent that development consent is required for development, none of the following is required to be obtained for the development or given in relation to it—*
 - a) *planning permission; ...*
 - b) *consent under section 36 or 37 of the Electricity Act 1989 (c. 29) (construction etc. of generating stations and installation of overhead lines); ...*

168. Within Part 5, by section 37: (Emphasis added)

- 1) *An order granting development consent may be made only if an application is made for it.*
- 2) *An application for an order granting development consent must be made to the Secretary of State...*

169. Within Part 6, by section 90: (Emphasis applied)

- 1) *The Examining authority's examination of the application is to take the form of consideration of written representations about the application...*

170. By section 91:

- 1) Subsections (2) and (3) apply where the Examining authority decides that it is necessary for the Examining authority's examination of the application to include the consideration of oral representations about a particular issue made at a hearing in order to ensure—
 - a) adequate examination of the issue, or
 - b) that an interested party has a fair chance to put the party's case.
- 2) The Examining authority must cause a hearing to be held for the purpose of receiving oral representations about the issue...

171. By section 98: (Emphasis added)

- 1) The Examining authority is under a duty to complete the Examining authority's examination of the application by the end of the period of 6 months beginning with the day after the start day.
- 2) The start day is the day on which the meeting required by section 88 is held or, if that meeting is held on two or more days, the later or latest of those days.
- 3) The Examining authority is under a duty to make its report under section 74(2)(b) or 83(1)(b) by the end of the period of 3 months beginning with —
 - a) the deadline for completion of its examination of the application ...

172. By section 99:

When the Examining authority has completed its examination of the application, it must inform each of the interested parties of that fact.

173. Within Part 7, Chapter 1, by section 120: (Emphasis added)

- 1) An order granting development consent may impose requirements in connection with the development for which consent is granted.
- 2) The requirements may in particular include —
 - a) requirements corresponding to conditions which could have been imposed on the grant of any permission, consent or authorisation, or the giving of any notice, which (but for section 33(1)) would have been required for the development;
 - b) requirements to obtain the approval of the Secretary of State or any other person, so far as not within paragraph (a)...
- 3) An order granting development consent may make provision relating to, or to matters ancillary to, the development for which consent is granted.
- 4) The provision that may be made under subsection (3) includes in particular provision for or relating to any of the matters listed in Part 1 of Schedule 5.
- 5) An order granting development consent may—
 - c) include any provision that appears to the Secretary of State to be necessary or expedient for giving full effect to any other provision of the order;...
- 6) In subsection (5) “statutory provision” means a provision of an Act or of an instrument made under an Act.
- 7) Subsections (3) to (6) are subject to subsection (8) and the following provisions of this Chapter.

174. By Part 1 of Schedule 5, The Matters, paragraph 1 provides: (Emphasis added)

The acquisition of land, compulsorily or by agreement.

175. Paragraph 6 provides:

Keeping electric lines installed above ground.

176. Paragraph 10 provides: (Emphasis added)

The protection of the property or interests of any person.

177. Within Part 7, Chapter 1, by section 122:

- 1) *An order granting development consent may include provision authorising the compulsory acquisition of land only if the Secretary of State is satisfied that the conditions in subsections (2) and (3) are met.*
- 2) *The condition is that the land—*
 - a) *is required for the development to which the development consent relates,*
 - b) *is required to facilitate or is incidental to that development, or*
 - c) *...*
- 3) *The condition is that there is a compelling case in the public interest for the land to be acquired compulsorily.*

178. Within Chapter 2, by section 153:

Schedule 6 (changes to, and revocation of, orders granting development consent) has effect.

179. Within Schedule 6, paragraph 1 provides:

- 1) *This paragraph applies for the purposes of this Schedule.*
- 2) *“The applicant”, in relation to a development consent order, means the person who applied for the order.*
- 3) *“A successor in title of the applicant” means a person who—*
 - a) *derives title to the land from the applicant (whether directly or indirectly), and*
 - b) *has an interest in the land.*
- 4) *...*
- 5) *“Development consent order” means an order granting development consent.*
- 6) *“The land”, in relation to a development consent order, means the land to which the order relates or any part of that land.*

180. By paragraph 2:

- 1) *The Secretary of State may make a change to a development consent order if the Secretary of State is satisfied that the change is not material. This is subject to sub-paragraph (13)...*
- 2) *In deciding whether a change is material, the Secretary of State must have regard to the effect of the change, together with any previous changes made under this paragraph, on the development consent order as originally made.*

181. By paragraph 3: (Emphasis added)

- 1) *The Secretary of State may by order make a **change** to, or revoke, a development consent order.*
- 2) *The power conferred by sub-paragraph (1) may be exercised only in accordance with—
 - a) *the following provisions of this paragraph, and*
 - b) *paragraphs 4 and 5.**
- 3) *The power may be exercised without an application being made if the Secretary of State is satisfied that—
 - a) *the development consent order contains a significant error, and*
 - b) *it would not be appropriate for the error to be corrected by means of the power conferred by paragraph 1 of Schedule 4 or paragraph 2 of this Schedule...**
- 6) *If a development consent order is changed or revoked in the exercise of the power conferred by paragraph 3(1), the Secretary of State must give notice of the change or revocation to such persons as may be prescribed...*

182. By paragraph 5: (Emphasis added)

- 1) *This paragraph applies in relation to the power conferred **by paragraph 3(1)** to make a **change to**, or revoke, a development consent order.*
- 2) *The power may not be exercised after the end of the period of 4 years beginning with the date on which the relevant development was substantially completed.*
- 3) *Sub-paragraph (2) does not prevent the exercise of the power—
 - a) *in relation to requirements imposed by the development consent order in connection with the relevant development, or*
 - b) *to revoke the development consent order.**
- 4) *The power includes power—
 - a) *to require the removal or alteration of buildings or works;*
 - b) *to require the discontinuance of a use of land;*
 - c) *to impose specified requirements in connection with the continuance of a use of land;*
 - d) *to impose new requirements in connection with the relevant development;*
 - e) *to remove or alter existing requirements...**
- 5) *...*
- 6) *...*
- 7) *“The relevant development” is the development for which consent is granted by the development consent order.*

Case Law

183. In Section F of its Written Submissions, ARU has referred previously to the relevant case law in relation to the various matters including compulsory acquisition of land and refers the ExA and the Secretary of State to the same.
184. It is common ground with NGET as the Applicant that the Secretary of State was entitled in law to grant up to as much of (or less than) the development as had been applied for. See *Kent County Council v Secretary of State for the Environment* (1977) 33 P&CR 70 at 76.
185. Importantly, however, NGET as the Applicant disputes the law in respect of compulsory purchase. In essence, NGET sets itself at odds with the High Court and Court of Appeal judgments whereas ARU aligns itself with those judgments. Therefore, ARU sets out below for convenience for the ExA and Secretary of State particular parts of Section F that have emerged as highly relevant as at Deadline 6 (7th July 2026).
186. *Statutory provisions* dealing with the calculation of compensation and interest *were intended by Parliament to protect the owner or occupier* who was being dispossessed, the statutory provisions in issue *were to be construed in favour of the owner or occupier*. See *Chilton v Telford Development Corporation* [1987] 1 WLR 872 in which the Court of Appeal followed its then recent decision in *Prest*. In particular, as at 1987, where there was a choice in relation to the construction of a statutory provision, that choice is required by the common law to be construed in favour of the land owner:

So one is left here with a provision which has on its face an open-ended power granted to the acquiring authority to act or not to act. It may at least be questioned whether that was entirely the intention of Parliament in enacting what are essentially provisions for the protection of an owner or occupier who is subjected to the necessary, but nevertheless draconian, powers of the acquiring authority to dispossess him of his title and occupation of his land.

*For my part, in approaching the construction of these statutory provisions I have two concepts in mind: first, to give to this part of the legislation, if it is open to do so, a purposive construction, bearing in mind the general considerations and need for these provisions. Secondly, to bear in mind that it is a statute which is **depriving the citizen of his rights in property and his title**, and the right to enjoy occupation of his lands, or perhaps somebody else's lands...*

... choosing between the two alternative approaches to this legislation, and I hope fairly recognising the lacuna which exists for practical purposes in the day-to-day carrying out of these exercises, I adopt the construction which is favourable to the owner and occupier of the land, because these sections, although incidentally dealing with calculation of compensation and interest, were primarily enacted for the protection of such a person...

187. That remains the correct approach as recently as 2011 when the Supreme Court applied the same in its determining the correct approach to the construction of statutory terms relating to the development of land in circumstances of compulsory purchase for development immediately after a compulsory purchase order had been confirmed. See *R(oao Sainsbury's Supermarkets Ltd) Wolverhampton City Council* [2011] 1 AC 437.. The Supreme Court held:

11. Recently, in the High Court of Australia, French CJ said in *R & R Fazzolari Pty Ltd v Parramatta City Council* [2009] HCA 12, paras 40, 42, 43:

"40. Private property rights, although subject to compulsory acquisition by statute, have long been hedged about by the common law with protections. These protections are not absolute but take the form of interpretative approaches where statutes are said to affect such rights."

"42. The attribution by Blackstone, of caution to the legislature in exercising its power over private property, is reflected in what has been called **a presumption, in the interpretation of statutes, against an intention to interfere with vested property rights** ...

"43. The terminology of 'presumption' is linked to that of 'legislative intention'. As a practical matter it means that, **where a statute is capable of more than one construction, that construction will be chosen which interferes least with private property rights.**"

188. NGET disagrees with the Court of Appeal in 1987 and with the Supreme Court in 2011. By contrast, ARU agrees with both the Court of Appeal in 1987 and with the Supreme Court in 2011 and respectfully invites the ExA, and in turn, the Secretary of State to also agree with those Courts in respect of their lawful judgments.

189. The Supreme Court in *Sainsbury's Supermarkets Ltd* also underscored the common law obligation on the ExA (and the Secretary of State) to be "**most** carefully scrutinized" the evidence asserted (not by the landowner but) by the acquiring authority by affirming in 2011 the *Prest* case:

10. In *Prest v Secretary of State for Wales* (1982) 81 LGR 193, ...
...Watkins LJ said, at pp 211–212:

"The taking of a person's land against his will is a serious invasion of his proprietary rights. The use of statutory authority for the destruction of those rights **requires to be most carefully scrutinised**. The courts must be vigilant to see to it that that authority is not abused. It must not be used unless it is clear that the Secretary of State has allowed those rights to be violated by a decision based upon the right legal principles, adequate evidence and proper consideration of the factor which sways his mind into confirmation of the order sought."

190. In respect of any ambiguity in relation to the evidence asserted by the Applicant, the Supreme Court also affirmed *Prest*:

10. In *Prest v Secretary of State for Wales* (1982) 81 LGR 193, 198 Lord Denning MR said:

"I regard it as a principle of our constitutional law that no citizen is to be deprived of his land by any public authority against his will, unless it is expressly authorised by Parliament and the public interest decisively so demands ..."

191. The part of *Prest* cited above by the Supreme Court derives from a wider passage held by the Court of Appeal (and applied in *Chiltern* by that Court in the following year (1987)). That is, in *Prest* Lord Denning held:

These findings give rise to several points of law.

The use of compulsory purchase powers

*The first is fundamental. To what extent is the Secretary of State entitled to use compulsory powers to acquire the land of a private individual? It is clear that no Minister or public authority can acquire any land compulsorily except the power to do so be given by Parliament: and Parliament only grants it, or should only grant it, when it is necessary in the public interest. In any case, therefore, where the scales are **evenly balanced** — for or against compulsory acquisition then the decision — by whomsoever it is made — should come down **against** compulsory acquisition. I regard it as a principle of our constitutional law that no citizen is to be deprived of his land by any public authority against his will, unless it is expressly authorised by Parliament and the public interest decisively so demands: and then only on the condition that proper compensation is paid, see *Attorney-General v. De Keyser's Royal Hotel Ltd.* (1920) A.C. 508 . If there is any **reasonable** doubt on the matter, the balance must be resolved in favour of the citizen. This principle was well applied by Mr. Justice Forbes in *Brown v. Secretary of State for the Environment* (1978) P. & C.R. 285 , where there were alternative sites available to the local authority, including one owned by them. He said (at page 291):*

“It seems to me that there is a very long and respectable tradition for the view that an authority that seeks to dispossess a citizen of his land must do so by showing that it is necessary ... If, in fact, the acquiring authority is itself in possession of other suitable land other land that is wholly suitable for that purpose – then it seems to me that no reasonable Secretary of State faced with that fact could come to the conclusion that it was necessary for the authority to acquire other land compulsorily for precisely the same purpose.”

192. It remains plain as a pike staff that since 1986, the law has and continues some decades later to require: “where the scales are **evenly** balanced — for or against compulsory acquisition then the decision — by whomsoever it is made — should come down **against** compulsory acquisition “ and if there is “any **reasonable** doubt on the matter, the balance must be resolved in favour of the citizen”. That is, where there is an evidenced doubt – or ambiguity – the common law requires that ambiguity to be resolved in favour of the citizen. This is yet another example of the *public law equivalent* of the private law concept of ‘*contra proferentum*’ approach being applied in the public law sphere of compulsory acquisition but applied to the evaluation of evidence (as it is to the construction of statutes).

193. The “interpretation of planning policy is a matter for the court”. In the decision of the *Supreme Court* in *Tesco Stores Ltd. v Dundee City Council* [2012] UKSC 13 , Lord Reed held:

18... As in other areas of administrative law, the policies which it sets out are designed to secure consistency and direction in the exercise of discretionary powers, while allowing a measure of flexibility to be retained. Those considerations point away from the view that the meaning of the plan is in principle a matter which each planning authority is entitled to determine from time to time as it pleases, within the limits of rationality. On the contrary, these considerations suggest that in principle, in this area of public administration as in others (as discussed, for example, in *R (Raissi) v Secretary of State for the Home Department*), policy statements should be interpreted objectively in accordance with the language used, read as always in its proper context.

19. That is not to say that such statements should be construed as if they were statutory or contractual provisions. Although a development plan has a legal status and legal effects, it is not analogous in its nature or purpose to a statute or a contract. As has often been observed, development plans are full of broad statements of policy, many of which may be mutually irreconcilable, so that in a particular case one must give way to another. In addition, many of the provisions of development plans are framed in language whose application to a given set of facts requires the exercise of judgment. Such matters fall within the jurisdiction of planning authorities, and their exercise of their judgment can only be challenged on the ground that it is irrational or perverse (*Tesco Stores Ltd v Secretary of State for the Environment and ors* , per Lord Hoffmann, p 780). Nevertheless, planning authorities do not live in the world of Humpty Dumpty: they cannot make the development plan mean whatever they would like it to mean.

20. The principal authority referred to in relation to this matter was the judgment of Brooke LJ in *R v Derbyshire County Council, ex p Woods* (p 290). Properly understood, however, what was said there is not inconsistent with the approach which I have described. In the passage in question, Brooke LJ stated

'If there is a dispute about the meaning of the words included in a policy document which a planning authority is bound to take into account, it is of course for the court to determine as a matter of law what the words are capable of meaning. If the decision maker attaches a meaning to the words they are not properly capable of bearing, then it will have made an error of law, and it will have failed properly to understand the policy.' ...

194. Tesco was applied in the sphere of the Planning Act 2008 in *R(on the application of Save Stonehenge World Heritage Site Limited) v Secretary of State for Transport* [2021] EWHC 2161 (Admin), at Appendix 1, paragraph 1(f): (Emphasis added)

The interpretation of planning policy is a matter for the court. In *R (Scarisbrick v Secretary of State for Communities and Local Government* [2017] EWCA Civ 787, the Court of Appeal considered the interpretation of national policy statement for nationally significant hazardous waste infrastructure under the Planning Act 2008. See paragraphs 5-8. Lindblom LJ (with whom the other Lord Justices agreed) held:

"19. The court's general approach to the interpretation of planning policy is well established and clear (see the decision of the Supreme Court in *Tesco Stores Ltd. v Dundee City Council* [2012] UKSC 13, in particular the judgment of Lord Reed at paragraphs 17 to 19). The same approach applies both to development plan policy and statements of government policy (see the judgment of Lord Carnwath in *Suffolk Coastal District Council v Hopkins Homes Ltd.* and *Richborough Estates Partnership LLP v Cheshire East Borough Council* [2017] UKSC 37, at paragraphs 22 to 26). Statements of policy are to be interpreted objectively in accordance with the language used, read in its proper context (see paragraph 18 of Lord Reed's judgment in *Tesco Stores v Dundee City Council*). The author of a planning policy is not free to interpret the policy so as to give it whatever meaning he might choose in a particular case. The interpretation of planning policy is, in the end, a matter for the court (see paragraph 18 of Lord Reed's judgment in *Tesco v Dundee City Council*). But the role of the court should

not be overstated. Even when dispute arises over the interpretation of policy, it may not be decisive in the outcome of the proceedings. It is always important to distinguish issues of the interpretation of policy, which are appropriate for judicial analysis, from issues of planning judgment in the application of that policy, which are for the decision-maker, whose exercise of planning judgment is subject only to review on public law grounds (see paragraphs 24 to 26 of Lord Carnwath's judgment in Suffolk Coastal District Council). It is not suggested that those basic principles are inapplicable to the NPS – notwithstanding the particular statutory framework within which it was prepared and is to be used in decision making."

**APPLICATION BY NATIONAL GRID ELECTRICITY TRANSMISSION PLC
FOR
A DEVELOPMENT CONSENT ORDER
PURSUANT TO SECTION 37 PLANNING ACT 2008
FOR
THE NORWICH TO TILBURY ELECTRIC LINE ABOVE GROUND

PLANNING INSPECTORATE REFERENCE: EN020027**

THIRD WITNESS STATEMENT

CAROLINE FLANAGAN

On behalf:

Interested Party Reference Number: NTOT-AFP2247 and F1201D06F

1. BACKGROUND AND QUALIFICATION

- 1.1 My name is Caroline Flanagan.
- 1.2 This is my Third Witness Statement in support of the position of Anglia Ruskin University to maintain the safe operation and functioning of its Equine College at ARU Writtle. I am the Head of School (Agriculture, Animal and Environmental Sciences) at Anglia Ruskin University (“**ARU**”). I have in excess of thirty years’ experience working in higher education, delivering degree and postgraduate level courses across a range of land-based courses, including those requiring horses as a practical resource (equine and veterinary physiotherapy awards).
- 1.3 In my role I have personally delivered modules linked to the awards mentioned, plus worked alongside a large team of equestrian experts over many years. Our combined knowledge encompasses all aspects of equine welfare, alongside a substantial wealth of experience in supporting students to successfully achieve their awards. Importantly, the development of practical competency is a major component of everything that we teach, so the safe and continued access to a population of horses is vital.
- 1.4 The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true. Where I refer to information supplied by others, the source of the information is identified; facts and matters derived from other sources are true to the best of my knowledge and belief.
- 1.5 There is now produced and shown to me a bundle of true copy documents marked “Exhibit CF1”. All references to documents in this statement are to Exhibit CF1 unless

otherwise stated. References to tab numbers in this statement are to the respective tabs in Exhibit CF1 in the format CF1/[x].

2. INTRODUCTION & SUMMARY

2.1 This third witness statement describes the real importance of the maintenance of a suitable quality of groundscape to support horses as they traverse on their hooves back and forth over the ground, and by reference to real life examples and experiences of the impact of groundworks on equine land use, equine welfare and human welfare, when that quality is not maintained.

2.2 This witness statement also sets out ARU Writtle's expert research evidence in relation the effect of micro electric shocks on horses in relation to their resulting behaviour, welfare and consequential equine and handler safety as detailed in the article by Rosa Verwijns MSc FHEA CEBC ABTC-AAB attached at Exhibit CF1/1.

2.3 My witness statement sets out the evidence and justification for a series of Requirements to be imposed on the draft development consent order. In summary, these are as follows:

- a) A Requirement: to exclude new electrical cables from oversailing the paddock land of ARU Writtle Educational Establishment. This is achievable by constructing pylon reference TB166 on its existing alignment but farther North, and references TB165 and TB164 farther West, and by which resulting geometry between these pylons, would ensure that the new line would remain inside the Order limits of deviation Exhibit CF1/2 but outside of the paddock areas of ARU Writtle Exhibit CF1/3. Such a requirement would be in line with the Department of Energy and Climate Change: Power Lines: Control of Microshocks (July 2013) and its normal good practice where (as here) such oversailing by a new line of an existing school land *is* actually avoidable;
- b) A Requirement: to ensure that the re-routing through paddock areas of local distribution electrical cables along underground routes is exclusively by means of below-ground drilling (by UKPN as the licensed distributor). This ensures the paddock ground level would remain undisturbed and provides necessary certainty for the subsisting safe functioning of ARU Writtle during crystallisation of the project;
- c) (So far as any part of the ground surface of any paddock is compacted by project-related works or processes), a Requirement: to ensure that any disturbed paddock surface area be reinstated forthwith to its pre-existing *status quo* suitable for equine activity without risk to a horse from such ground disturbance. This provides necessary certainty as above; and
- d) A Requirement: to ensure the provision of temporary traffic light signals and related signage at the location of the crossing point between the two parts of ARU Writtle on

Cow Watering Lane by which to ensure the safe crossing of equine and pedestrian traffic during the diversion of traffic by NGET along that Lane. This provides necessary certainty as above.

3. PROPOSED GROUNDWORKS ON ARU WRITTLE LAND

- 3.1 ARU Writtle is an Educational Establishment in the form of an Equine Centre providing Equine Further Education to children aged 16 and upwards, and both Equine and Veterinary Physiotherapy Higher Education to students aged 18 and upwards alongside its herd of 90 horses, over a campus comprised of both buildings and open paddock areas on each side of Cow Watering Lane Exhibit CF1/4. The herd is accommodated in the paddocks and teaching of all ages of students also occurs in the paddocks as well as the buildings.
- 3.2 National Grid Electricity Transmission (“NGET”) has applied for a development consent order (“DCO”) by which to construct a line of pylons between Norwich to Tilbury, between each of which would be strung above-ground electrical cables. I am advised and understand that the DCO terms adopt the “Rochdale Envelope” approach by which the DCO terms establish volumetric and other parameters inside of which notional box the detail content of the proposed authorised development necessarily remains unknown. In particular, the actual locations of the pylons inside of the notional box and of the line of the electrical cable lines remains unfixed and would be authorised to be anywhere inside of that notional box.
- 3.3 The notional box would traverse land including that of ARU Writtle. Inside of that notional box, the proposed line of the electrical cables would cross the routes of pre-existing: a) highways; and b) local distributor electric cables strung between wooden poles.
- 3.4 NGET desires to protect the vehicles using certain highways from the risk of electrical lines falling on vehicles, whilst the lines are being installed and tightened between pylons, by means of large scaffolding frames erected on third party land on each side of the relevant highway, and by means of a telehandler (a tractor form of forklift truck).
- 3.5 The disruption caused by NGET’s new pylon and cable line to local distribution cables lines would result in the relocation of the local cables, including by their being situated underground close to their original line.
- 3.6 The Plan “Figure 4.1- Project Description – Proposed Project Design, Section F, page 50 of 63, Document Reference 6.4.F1 (“the EIA Plan”) illustrates the situations described in (a) and (b) above in the location of ARU Writtle Land, Exhibit CF1/5
- 3.7 The EIA Plan identifies (in yellow colouration to the North-East of pylon reference “TB 166”) an area inside of the notional box where NGET desire to erect scaffolding on the

Western extents of paddocks inside the ARU Land in the North-West part of ARU Writtle adjacent to the highway of Newney Green lane to the immediate West of the scaffolding. The EIA Plan also identifies a mirror extent of scaffolding to the West of the highway of Newney Green lane. The purpose of the scaffolding contended for by NGET appears to be to protect actual vehicular users of that highway from the risk of falling electrical cable lines being attached to the pylons of “TB166” and “TB165” to its North, *during* the period of that cable stringing process. This location forms part of “Works No. 17” (“Route TB”) in Schedule 1 to the draft DCO.

- 3.8 Page 61 of the Environmental Statement, Document 6.4, Environmental Statement Chapter 4 - Project Description, describes and illustrates the following at crossings:

Crossing Protection

4.8.57 Where the new overhead line crosses a road, railway line or navigable watercourse, scaffolding would be used to protect the crossing during construction. During site set up, scaffolding would be placed on either side of the feature. Each scaffold would be designed for the individual crossing that it would protect. The work area required for scaffold protection is dictated by the angle at which the overhead line crosses the asset which it is protecting. Crossing protection/scaffold is shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1).

- 3.9 *4.8.58 Crossing protection would be made from steel scaffolding, with a net made of steel wire bonds anchored from scaffold to scaffold (see Image 4.11). Netting would be pulled across using karabiners to connect it to the steel wire bonds. The scaffold would be capable of withstanding a conductor being dropped on it in the unlikely event that this were to occur. The working area around the scaffold would be sufficient to erect the scaffold and to install and accommodate ground anchors or kentledge blocks required to stabilise the structure and catenary wires supporting the nets. Temporary road closures would be required to facilitate the erection and dismantling of the scaffold netting across the public highway. For a minor road, this would be up to approximately 30 minutes, out of peak traffic times. For a major road, this would be up to approximately four hours at night-time.*

Image 4.11 Example of scaffold protecting a road crossing



- 3.10 The presence of the weight of the proposed scaffolding actually resting for a period on ARU paddock land would result to crush the ground surface of the footprint of the scaffold structure due to the actual weight of the metal poles and crushing due to the weight of the tractor-wheels of the telehandler (envisaged by NGET to be used by a Main Contractor to erect the scaffold structure) traversing of the ground of and close to the scaffold, as well as in its stringing of cables between pylon references TB165 and TB166.
- 3.11 In addition to the yellow coloured area on the EIA Plan, that Plan shows the location to the Northern side of the ARU paddock areas of an area coloured blue demarcating the envisaged removal of the above ground cables of the local distribution undertaker and its envisaged relocation of new local distribution of those cables on ARU paddock land. The EIA Plan identifies that location in the area coloured blue immediately to the South of Pylon reference "TB 165". The straight-side part of the blue area connotes the existing area of the overhead cable line. The curving-side part of the blue area connotes the proposed underground route along the Southside of the stream inside of the ARU Land. It can be seen from that Plan that the curving-side part of the blue area would extend over the paddocked areas to the North of ARU Writtle.
- 3.12 Works Plan, Section F, Sheet 8, pdf page 10, shows between "TB165" and "TB166" the above notional situation in respect of Works No. 17 in greater detailed scale. There appears to be no Works references at all in relation to the UKPN local distributor relocation of its electrical cables on ARU Land. In particular, Works No. 31 starts on Section E, Sheet 7, and terminates on Section F, Sheet 1, and then Works No. 32 starts at Section G, Sheet 4. Therefore, UKPN appears to rely on "associated development" and paragraph (f) for the construction and installation of electric lines and cables and pylons, and n) such other works, as may be necessary or expedient for the authorised development. There is no requirement to underground new UKPN cable lines.
- 3.13 Requirement 4(a) requires adherence by NGET and "UKPN" to the "Code of Construction Practice". The most recent version of that Code is June 2026. The Code includes in Table 6.1 "Mitigation Measures" includes no requirement to ensure undergrounding of cables are drilled (rather than installed by trenches and no requirement to ensure restoration of ground surfaces to their original status quo).
- 3.14 The Land Plans, Section F, Sheet 8 Exhibit CF1/6 show the same area on the North edge of the paddock area of ARU Writtle but coloured orange and a key to that plan identifies the orange area as "Class 3 – compulsory acquisition of rights – underground cable system". Table 1.1 of the Statement of Reasons identifies Class 3 as envisaged subject to Article 25 of the dDCO. Article 25 of the dDCO that was applied for on 29th August 2025 provides for the compulsory acquisition of the rights.
- 3.15 However, I note that on the 24th June 2026, the representative of "UKPN" explained to the ExA that UKPN is not actually seeking compulsory acquisition of rights but is seeking at this time bespoke agreements with each party whose land on which it desires to carry

out works. ARU Writtle (by way of its Agent Jane Kenny) has explained to UKPN in its (single, introductory) teams meeting on 23 April 2026 with UKPN that the paddock-nature of the land means that below ground drilling of the cable is necessary by ARU to ensure the ongoing stability of the ground surface. This would avoid the need for excavation of trenches and the resulting sterilisation of the trenched area of the paddock from use by horses for a considerable period.

4. **IMPACT OF GROUNDWORKS ON EQUINE LAND USE AND WELFARE**

- 4.1 Groundworks and the disturbance of the soil surface within horse pastures, and upon which horses stand, walk, or otherwise traverse, present a significant and well-evidenced risk to equine safety. The risk is primarily due to the disruption of ground surface stability and the prolonged period required for soils to recover their structural integrity at surface level. Horses are large animals, typically weighing between 500–700 kg, and rely on consistent, well-compacted ground to safely absorb and distribute the forces generated by hoof impacts on the ground surface during their movement. When soil is compacted, excavated, loosened, or reprofiled, this natural ground surface soil quality of compaction suitable for equine traverse is lost, and instead a ground surface is created of uneven, unstable, and potentially hazardous footing for horses.
- 4.2 In the situation of ARU Writtle, it is evident that the placement of metal scaffolding onto the ground surface of paddocks on the Western part of ARU Writtle, and of disruption from unspecified UKPN local distribution works on the Northern perimeter paddock areas of ARU Writtle will result in: a) compaction, excavation, loosening, or reprofiling of this natural ground surface inside the area of the Order limits across the extent of the ARU Land inside the notional box of the proposed “Rochdale Envelope”; and b) the need for restoration of the ground surface of the areas of several paddocks over an extended period of time.
- 4.3 The British Horse Society (“BHS”) emphasises that *pasture* used for horses must provide a “flat and safe surface” and should be regularly checked for holes, damage, or irregularities that could cause injury. Disturbed ground directly conflicts with this guidance, as it commonly introduces depressions, ridges, soft patches, and hidden voids such as backfilled trenches. Even where surfaces *appear* level, *underlying inconsistency in soil density* can persist for extended periods, increasing the likelihood of *missteps*.
- 4.4 The risks associated with such conditions are real, not at all fanciful nor theoretical, and are clearly reflected in both research and insurance data. A UK study funded by The Horse Trust found that 40% of horses experienced a traumatic injury within a single year, with 62% of those injuries occurring during field turnout rather than ridden activity (see article at <https://horsetrust.org.uk/40-of-horses-injured-each-year-according-to-survey-funded-by-the-horse-trust/>). This demonstrates that the pasture environment itself is the most common setting for injury. Complementing this, UK insurance data shows that injuries occurring in the field or stable—such as fractures, wounds, and trauma—are

among the most frequent causes of equine insurance claims, often resulting from accidents such as slips, falls, or other external incidents. These patterns strongly indicate that environmental factors, including ground conditions, are a major contributor to injury risk.

- 4.5 ARU has a herd of 90 horses. Unfortunately, over many years, the operation at ARU Writtle has not been immune from such unfortunate incidences. Several specific experiences of this type of pasture-related injury in horses as a result of works to the ground surface of ARU Writtle paddock areas. One in particular graphically evidences the very real risk arising from comparatively small areas of disturbed and then supposedly 'restored' ground. This memorable case involved a student-owned animal falling as a result of a very small area of disturbed soil following the removal of a telegraph pole. A telegraph pole leaves only a very small diameter hole to be restored but, the horse slipped on the restored surface and fell. The resulting huge wound in the animal entailed vet bills that ran to five figures, and ultimately the animal had to be put to sleep. So, we at ARU Writtle have real experience of the reality of the risks engendered by changes to the ground surface of pasture paddock areas, their foreseeable crystallisation and their catastrophic consequences.
- 4.6 Veterinary evidence further supports the concerns around disturbed soil within a pasture setting such as that of the ARU Writtle paddock areas. Tendon and ligament injuries—among the most serious and costly equine injuries—are known to occur simply from a misstep or movement on uneven, soft, or inconsistent ground, even in pasture settings. Such injuries include suspensory ligament damage and strains to the deep digital flexor tendon, which can occur when a horse's limb sinks unexpectedly or is subjected to uneven loading. Documented cases describe horses becoming acutely lame in the field without obvious cause, later diagnosed with significant ligament damage, consistent with injury from unstable footing.
- 4.7 Crucially, both in relation to safe use of paddocks and the ongoing operation of ARU Writtle paddock areas for tuition, the *recovery* of disturbed soil for the purposes of equine traverse is a slow process. Natural re-compaction relies on rainfall, gravity, biological activity through the soil structure, and repeated particular surface pressure, and can take many months to over a year, depending on soil type. Even with mechanical intervention such as rolling, a safe and resilient pasture ground surface typically requires at least one growing season (6–12 months) to re-establish fully to a sound surface suitable and safe for equine use. In particular, clay soils, such as those at ARU Writtle, may compact unevenly and become prone to cracking and opening of voids or crevices creating uneven ground. During this period, grass regrowth can create a misleading appearance of recovery, masking underlying structural weakness and the ongoing presence of hazards to equine passage.

- 4.8 Works that result in groundworks therefore introduce *both* immediate and long-term hazards to horse pasture by disrupting soil compaction and creating uneven or unstable surfaces. Evidence from veterinary practice, welfare guidance, and insurance claims demonstrates that such conditions are closely associated with a high incidence of field-based injuries. Given the extended timeframe required for soil to regain safe compaction, any disturbed pasture must be carefully managed and allowed sufficient time to recover before being deemed suitable for equine use.

UKPN DRILLING REQUIREMENT

- 4.9 I note that, after its initial introduction meeting by UKPN in March 2026, there has been only one meeting with UKPN representatives at which sub-surface drilling to provide for the new local distribution cable be provided under the ground surface of the Northern paddock part of ARU Writtle Land was discussed Exhibit CF1/7. At the CAH 3 on 24th June 2026, UKPN indicated its desire to first continue discussions with landowners before considering compulsory acquisition of land. I further note that the Examination Hearing Period ends on 19th August 2026 and Deadline 6 is on the 7th July 2026, that NGET applied for the DCO on 29th August 2025 without first having agreed with UKPN whether or not UKPN would need to compulsorily acquire land including that of ARU Writtle, or may rely on permitted development rights instead of the DCO terms, and that both NGET and UKPN did not agree terms of a design and development agreement with UKPN until November 2025 (as UKPN explained to the ExA at CAH 3 on 24th June 2026), and that this appears to explain the slothful pace of progress by UKPN to agree with ARU Writtle how UKPN and ARU envisage situating new cables below ground whilst minimising issues for the ARU horse herd and students and colleagues. This all shows considerable uncertainty notwithstanding the ongoing operation of ARU Writtle as an Educational Establishment.
- 4.10 It seems to be unrealistic in the remaining limited time before 10th August 2026 that UKPN will be in a position to agree to drill below the ground level of ARU Land to install its desired new electrical cable route and the uncertainty created by NGET continues.
- 4.11 Therefore, I consider that a Requirement is justified as both necessary and achievable to ensure that the UKPN new below-ground cables are installed in relation to the ARU Writtle Land by means of drilling (and not, for example, by means of trench excavation and back-filling) and drilling occurs at a level below the plough zone of 1m below surface level. Such a depth below ground would likely avoid the potential for micro-shocks from sub-surface cables evidenced by the Article I refer to below, whilst ensuring the ground surface of the paddock areas in the location of UKPN below ground cables remains undisturbed, and, in turn, would ensure that the Equine Facility can continue to operate and function simultaneously with the installation of the desired cabling by UKPN.

6. MICROSHOCKS AND A MICRO-SITING CABLE REQUIREMENT AT ARU WRITTLE

- 6.1 As previously described in my Second Witness Statement, there are also real concerns regarding the potential for horses to experience low-level electrical currents (“microshocks”) passing through their bodies when a horse is within the immediate vicinity of the pylons’ overhead electrical cables. This concern is shared by the Department of Energy and Climate Change from as long ago as July 2013 when it published its Power Lines: Control of Microshocks and other indirect effects of public exposure to electric fields, A voluntary Code of Practice (July 2013)”. Page 4 describes that:

Microshocks can occur whenever a person and a conducting object almost touch under a power line and are not (by virtue of being connected to each other or both being connected to earth) at the same potential. The conducting object can be anything, and either the person or the object can be at a floating potential. In practice, experience has identified several common scenarios: ...

- *person riding, leading, or touching a horse or other animal ...*

- 6.2 Figure 1.1 of the NGET Response to the ExA’s 2nd Questions that related to ARU Writtle illustrates the envisaged centre line of new above ground electrical cables oversailing the Western parts of three existing paddock areas forming part of the ARU Writtle Educational Establishment. The Figure and its supporting text affirm the actual occurrence of microshocks in the linear area identified on Figure 1.1. The Department’s Code describes the link between both such overhead lines, via horses, to people, and the Response of NGET accepts the actual foreseeable occurrence of microshocks occurring between 2.0kV/m and 2.8kV/m in that linear area between pylons references TB165 to TB166. It seems to me common ground therefore that there will be actual microshocks to horses caused by the proposed oversailing electrical cables.
- 6.3 Horses are highly sensitive to electrical stimuli and may react unpredictably to even minor currents, sometimes refusing to cross certain areas, displaying signs of distress, or moving suddenly in a way that increases the risk of injury.
- 6.4 This issue is considered in more detail within a separate expert statement – a researched, evidenced and referenced “Article” - provided by my equine behaviour specialist colleague at ARU Writtle, Rosa Verwijs, contained as attached at CF1/1. Rosa’s Article highlights the actual mechanisms by which the shocks that stray voltage engendered by the proposed electrical overhead cable line traversing ARU Writtle paddock land may initiate and the potential behavioural and welfare implications for horses exposed to, and actually experiencing, such foreseeable electrical conditions, as well as resulting safety issues for students (both those aged 16 upwards and 18 upwards), as well as teaching and other staff.

- 6.5 The Department's Code provides on page 6 that "where reasonably practicable, electricity companies] avoid designing new power lines that would create fields of 5 kVm-1". In its Response, NGET proposes to raise the actual level above ground of the oversailing new electrical cables to seek to ensure that that figure is arrived at. However, as noted above, the dDCO is in "Rochdale Envelope" form and its internal content remains to be determined and a Main Contractor to be appointed. Further, the Code explains that the figure of 5kVm is sought to be achieved "if a new line over ... a school is unavoidable..."
- 6.6 It seems clear that the Order limits of deviation referred to in Article 5(1)(a) of the dDCO do not require the line of the new electrical cables to oversail the existing paddock area of the school but expressly enable the line of the cable anywhere inside of the Order limits such that it cannot be said that oversailing of school land is actually unavoidable.
- 6.7 Having regard to the Plans referred to above, and for reference to the EIA Plan, it is clear that new line can actually be avoided oversailing our school by ensuring the micro-siting of the pylons as follows: by constructing pylon reference TB166 on its existing alignment but farther North, and references TB165 and TB164 farther West, the resulting geometry between these pylons would ensure that the new line would remain inside the Order limits of deviation but outside of the paddock areas of ARU Writtle. I struggle to see how that is "unavoidable" in geometric terms nor within the flexibility sought by NGET in applying for a "Rochdale Envelope" type of consent.
- 6.8 Such ensured micro-siting of oversailing cable outside of ARU Writtle land would result in a significant reduction or total avoidance of the actual microshocks caused by the new lines to the horses of the 90 strong herd of ARU Writtle, and the resulting harm to children and students and colleagues alike that the Article referred to above describes, as well as align with the Department's good practice for new electrical lines.
- 6.9 I note that NGET described at the 24th June 2026 CHA3 issue specific hearing that it had in other locations agreed with existing landowners to "micro-site" pylons locations, and that the current Code of Construction includes a number of references to "micro-siting" in a number of general locations. Thus far in the Hearing Period, at 24th June 2026 and close to the end of that Period on 10th August 2026, NGET refuses to micro-site pylons in the vicinity of the AU Writtle Educational Establishment.
- 6.10 However, despite advancing a "Rochdale Envelope" type of project terms to retain maximum flexibility for its project and it being currently devoid of detail inside its notional box, NGET simultaneously refuses to date to voluntarily adhere to the Department's "normal good practice" to avoid oversailing schools notwithstanding that NGET would have the actual range of Order limits anywhere inside of which can be traversed by its new cables and including a location outside of the ARU Writtle paddock areas but inside the proposed Order limits. The true situation remains that oversailing of ARU Writtle is not actually "unavoidable" but remains "avoidable". Instead, NGET has jumped the Code

provision to avoid oversailing school land and relied on the consequent minimisation of the micro-shock figure to below 5kVm (by raising the height of the desired lines). By doing that, NGET has failed to grapple with, and refuses to adhere to, the Department's Code and its provisions in this particular location.

- 6.11 In line with the Department's guidance for "good line routing practice" and because oversailing is actually avoidable, a Requirement to ensure no new line oversails the school land at ARU Writtle. Such a Requirement is justified as both necessary for the reasons and evidence I have described above, and is achievable within the current terms of the dDCO by means of adding a micro-siting Requirement under Schedule 3 to ensure that in the location of ARU Writtle the line of deviation under Article 5(1)(a) is constrained to be within the gap as set out above. Such a Requirement also aligns with the Department's Code.
- 6.12 The practical outcome of the proposed micro-siting Requirement referred to above would be to relocate Northwestwards along Newney Green lane the oversailing line of new cables near to ARU Writtle and simultaneously so reduce the extent of scaffolding (if any) that NGET would desire to situate on ARU Writtle Land. It seems that there is no reason why NGET's Main Contractor could not rely on the Traffic Regulation Order of Article 49(1) and Schedule 13 of the dDCO Exhibit CF1/8 to close that lane for a period and it seems to me that the disruption to ARU Writtle Land paddock ground surfaces can be actually wholly avoided and, in turn, the Equine Facility could continue to operate and function safely simultaneously with the envisaged construction of the NGET pylons to its North West and West.

COW WATERING LANE SAFE CROSSING REQUIREMENT

- 6.13 Joseph Hough of KMC Transport Planning has provided expert evidence in a Technical Note on the need for traffic regulation measures to ensure the ongoing safe crossing of Cow Watering Lane highway by horses and their handlers moving between the two parts of ARU Writtle on either side of that highway. The route taken by that foot and hoof traffic is shown on the Plan (12th May 2026) submitted by Jane Kenny at Deadline 4 on behalf of ARU Writtle.
- 6.14 NGET proposes in its dDCO, Article 16(1)(a) and Schedule 8, to divert traffic along route "SMD-F-043" that is shown on the Access, Rights of Way and Navigation Plans, Section F, Sheet 8, along Cow Watering Lane. Exhibit CF1/9
- 6.15 As Mr Hough has explained in his two Technical Notes, and as also evidenced by the particular and sworn evidence of my colleague, Dan Cook, in his witness statement, the current situation is that horses and their handlers cross the Lane at a particular point and then move along the edge of Lane, as well as also at other times moving along a "hacking route" alone the edge of the Lane for a distance. Mr Cook has previously evidenced the very real risk generated by that proposed introduction of new drivers, and those with

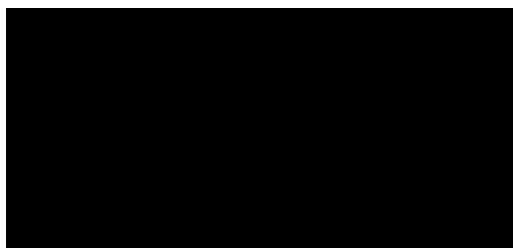
construction and noisy vehicles, and diverted drivers unfamiliar with the subsisting situation of the crossing, and that this change would pose to the current relatively safe regular daily crossing and re-crossing of the Lane by equine and pedestrian traffic at a particular point on the Lane.

- 6.16 The most recent version by NGET of its Outline Construction Traffic Management Plan (June 2026) was asserted by NGET at Deadline 4 to contain measures to ensure ongoing safe crossing by the mix of highway traffic at Cow Watering Lane resulting from NGET's project and the diversions of traffic that it requires. However, careful consideration of the recent version that Plan shows that it applies to the "PAR" routes and not to Cow Watering Lane. See, for example, Section 6, paragraphs 6.2.10 and 11, and in particular 6.2.12: "The driver information pack will be issued to each driver prior to them commencing work and will include: details of road safety concerns for the PARS (e.g. locations where pedestrians may be crossing the carriageway)".
- 6.17 Mr Hough has also described how NGET instead merely rely on the 'system' of permitting by which to avoid careful consideration of the real risks identifiable at this stage of the DCO process during the Hearing Period. He describes how NGET assert that the safety evaluation process necessarily in some way will pick up the identified highway risk situation at Cow Water Lane referred to above and provide for it somehow. Meaning no disrespect to NGET, I find this approach to defer careful consideration of a known highway safety issue to a later date most surprising and it is also impracticable. As Mr Hough explains, there is no guarantee that a person in due course would any relevant knowledge of the actual foreseeable highway risk to equine and pedestrian traffic that would result from the diversion by NGT and its future Main Contractor along the Lane. Further, it is clear that NGET refuses to ensure the safety of the crossing of the Lane during the diversion(s) for which it seeks powers under the dDCO. I consider that the above evidence demonstrates a very real need for a Requirement to be included in Schedule 3 of the dDCO to ensure that, as part of any Article 16 and Schedule 8 diversion of traffic along Cow Watering Lane, the traffic management measures identified by Mr Hough are and will remain in place throughout the diversion event. I understand the measures would comprise temporary traffic lights at the crossing point able to be initiated by the pedestrian traffic crossing the Lane and, thereby, would ensure the ongoing relatively safe crossing of the Lane by that pedestrian traffic.

Statement of Truth

I understand that proceedings for contempt of court may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief in its truth.

I believe that the facts stated in this Witness Statement are true.



Head of School (Agriculture, Animal and Environmental Sciences), Anglia Ruskin University

Dated: 7 July 2026

EXHIBIT CF1/1

**Expert Opinion: SHOCKS AND HORSES: A BEHAVIOUR AND WELFARE
PERSPECTIVE**

from



A. QUALIFICATIONS AND EXPERIENCE

1. I am a Senior Lecturer in Equine Behaviour and Nutrition at ARU Writtle.
2. At ARU Writtle, I have taught and conducted research in equine behaviour and welfare for the past 17 years. I have worked professionally in the field of equine behaviour for more than 20 years.
3. I am a Certified Equine Behaviour Consultant with the International Association of Animal Behavior Consultants (IAABC) and an Accredited Animal Behaviourist with the Animal Behaviour and Training Council (ABTC).
4. In addition to my academic and consultancy work, I serve on a number of equine welfare committees, including those of the British Horse Society and the National Equine Welfare Council, providing specialist behavioural expertise to support equine welfare initiatives and policy development.

B. INTRODUCTION AND BACKGROUND

5. I have been informed by ARU Writtle that National Grid Electricity Transmission (“NGET”) is seeking consent for a development consent order (“dDCO”) on the terms of the draft Order (currently at REP4-038). By Article 3(1), the dDCO would authorise NGET installing and keeping the authorised development referred to in Schedule 1, and also under paragraph (3) would authorise “UKPN” to carry out “UKPN Works”. Schedule 1 includes Works No. 17 that provides for an “overhead transmission electric line (Route TB) between Sections E and H and thereby including Section F. Within Schedule 1, the UKPN Works start at Works No.25 and end with Works No. 35 but include no reference to Section F, Sheet 8. The Works Plan, Section F, Sheet 8, identifies: a) the red outlined area of the land to which the dDCO relates and so inside of which the overhead cables would be contained; in its key: b) an orange dashed line inside of the red-outlined area shows the “Limits

of deviation: overhead lines”; c) a blue dashed line inside of the red-outlined area shows the “Limits of deviation: underground cables”; and d) a series of purple squares containing a purple “X” that denote “Proposed lattice pylons (not to scale)”. Article 5(1) would authorise “in respect of the overhead electric line and underground electric line works forming part of the development”, the *deviation* by NGET from the lines shown on the Works Plan *within* the limits of deviation shown on those plans and carry out construction activities for the purpose of the authorised development “*anywhere* within the Order Limits”. In Figure 1 of the NGET Response to ARU Writtle [REP4-384] and ExQ2 CA 2.1 and HW 2.22.1 and HW 2.2” of NGET, the Applicant has illustrated the overhead electrical line along the centre line of the “Limits of Deviation” and “illustrated maximum calculated electric fields from Spans TB165 to TB166” with “yellow contours detail[ing] where electric field would be at its maximum of 2.8kV/m directly under the conductors and the green contour indicates where the electric field reduces to between 2.8 and 2.0kV/m”. Paragraph 2.5.8 of the NGET Response describes that there would be an “electric field directly under the overhead line” between Pylon Spans TB165 and TB166, and that the “maximum electrical field” is envisaged to be “2.8kV/m” if the line is ensured to be at least 16m “over the paddock” in the yellow areas and changing to “2.0kV/m” in the green areas adjacent to the yellow area over the paddock. The reference to the “paddock” is to discrete paddocks that ARU Writtle identify as: a) “Paddock [INSERT]”; b) “Paddock [INSERT]”; and c) “Paddock [INSERT]”; all being situated to the North-Westernmost part of the educational establishment.

6. I understand that the NGET Response includes assertions, at paragraph 2.5.7 that “there is no evidence to suggest that horses are more susceptible to microshocks”; and at paragraph 2.6.4, that NGET “has not ... assessed [ARU Writtle] as a farm”. The former assertion on behalf of and by NGET is not correct for the reasons I give below in this Paper.
7. The authorising Department of Energy and Climate Change has published “Power Lines: Control of Microshocks and other indirect effects of public exposure to electric fields, A Voluntary Code of Practice” (July 2013)” (“the Code”). The Code states:

The Electricity Industry⁷ agrees that whenever new power lines are being designed and constructed, or whenever issues of the safety or acceptability of indirect effects arise in the context of existing power lines, it will follow the provisions of this Code of Practice. Government agrees that compliance with the provisions of this Code of Practice will be regarded as sufficient to demonstrate compliance with the exposure guidelines in as far as they relate to indirect effects, and hence with Government policy.

8. Footnote 7 states that: “This Code of Practice is agreed between Government and the Energy Networks Association (ENA). Formally, therefore, it binds only the member companies of ENA. However, Government and ENA hope that all network operators will follow these provisions.”. It is my understanding that the Code binds NGET (and also UKPN).

9. The Code states:

Indirect effects occur when an electric field induces charges on the surface of a conducting object. Those charges can then either interact with the electric field (e.g. when charges induced on human hairs have a force exerted on them by the field, which causes the hair to vibrate), or the charges can be transferred to another object. When that transfer of charges takes place between a person and another object in the form of a small spark across the gap between the two objects, it is known as a microshock. Once the two objects are touching, the continuous transfer of charge is known as the contact current.

Direct effects are protected against by quantitative exposure limits known as basic restrictions. However there are no equivalent limits to protect against indirect effects such as microshocks. The Code of Practice “Power Lines: Demonstrating compliance with EMF public exposure guidelines: A voluntary Code of Practice” states:

“For indirect effects, while the Guidelines give a cautionary reference level of 5 kV m⁻¹ for the general public as a trigger to fuller assessment of compliance with the exposure guidelines, using that as a limit is not the most appropriate way of dealing with indirect effects. Rather, there is a suite of measures that may be called upon in particular situations, including provision of information, earthing, and screening, alongside limiting the field which should be used to reduce the risk to the public of indirect effects...”

10. The Code further explains “Relevant characteristics of microshocks”:

The electric field produced by high-voltage overhead power lines induces charges on the surfaces of any objects that are exposed to it, or, expressing the same physical concept in a different way, any object that is not grounded acquires an electric potential (a voltage) from the field. When two conducting objects that are at different potentials touch, the potentials equalise by means of a transfer of charge from one to the other.

As the two objects get closer, the difference in potential between them is applied across a smaller and smaller gap. When the gap becomes small enough, and if the potential difference is large enough, the potentials equalise across the gap by means of a small spark. When one of the two objects is a person touching a conducting object, that small spark is concentrated on one very small area of the skin, typically a few tenths of a millimetre across. The total energy in the spark is very low, but because it is so concentrated and localised, it is experienced at that point of the skin as a small shock. The sensation can range from a small tingle through to pain...

The sensation of a microshock is similar to that caused by the static discharges commonly experienced in dry atmospheric conditions after frictional contact with a nylon carpet or car seat. Scientific investigations have shown that the voltages and charges are comparable for the two phenomena, and therefore any effects on the body can be presumed to be similar.

The size of a microshock depends on the size of the electric field, as it is this that determines the extent of charging of the objects concerned. It also depends on the sizes of the objects concerned, how well grounded or insulated they are, meteorological conditions, and the sensitivity of the skin (which varies over the body as well as from person to person).

Microshocks can occur whenever a person and a conducting object almost touch under a power line and are not (by virtue of being connected to each other or both being connected to earth) at the same potential. The conducting object can be anything, and either the person or the object can be at a floating potential. In practice, experience has identified several common scenarios:

- *person touches ungrounded motor vehicle*
- *person touches ungrounded fence*
- *ungrounded person touches grass with bare feet or legs*
- *person touches small objects (e.g. gardening utensils, washing and washing line), either or both ungrounded*
- *person touches metal parts of umbrella*
- *person touches golf clubs or golf umbrella*
- *person riding bicycle*
- *person riding, leading, or touching horse or other animal*
- *person touches another person*

As well as the actual physical sensation of the microshock, microshocks could in some circumstances give rise to further effects, either if the microshock causes a person to startle with dangerous consequences, or if repeated microshocks cause aversive responses to the situation that produces them...

Requirements for controlling microshocks

This Code of Practice recognises that there is no reasonable way to avoid microshocks in all circumstances, even in circumstances when they are at a frequency and severity that is clearly undesirable, and therefore that not all situations producing microshocks are expected to be remedied.

This Code of Practice also recognises that control of microshocks is not based on a simple quantitative limit...

Specifically:

- *Electricity companies will, where reasonably practicable, avoid designing new power lines that would create fields of 5 kVm⁻¹ or greater in homes, other land in residential use, their curtilage, and schools⁸*
 - *Note that existing good line-routing practice will normally achieve this anyway by routing lines away from existing homes and schools. If a new line over a home, its curtilage, or a school is unavoidable, a field below 5 kV m⁻¹ can be achieved by designing the line with an appropriate clearance. In the converse situation of new homes close to existing power lines, electricity companies will encourage sensitive design that avoids such situations, but no restrictions or controls are created by this Code of Practice.*
- *There is no requirement that clearances of existing overhead lines, or of new overhead lines except where they unavoidably pass over homes, other dwelling places, their curtilage, and schools, should be increased because of microshock issues, though this could be done voluntarily by electricity companies...*

11. I was requested by Caroline Flanagan (Head of School, ARU Writtle) to provide my expert opinion regarding the likely behaviour and welfare implications of the electric fields from the proposed positioning of electricity pylons and powerlines inside of the Limits of Deviation proposed to be situated on ARU Writtle land and as illustrated in Figure 1 of the NGET Response referred to above on the central axis of those Limits, inside of the red-outlined area identified on the Works Plans, Section F, Sheet 8. This Paper responds to that request.

12. The information presented below draws upon direct observations made by myself and those of other equine behaviour and welfare professionals from: behavioural cases; accounts; and examples from a range of publicly available sources; and my own professional experience within the equine industry. Where appropriate, these observations are considered in light of the available scientific literature and are accompanied by my interpretation and opinion.

13. Currently protocols are in place to ensure the safety of students and staff. These include testing the suitability of horses for teaching, hazard evaluation and risk assessment, and incident reporting systems. However, unpredictable and

random microshocks have the potential to provoke sudden behavioural responses in horses that may not be identified through existing assessment procedures, thereby creating an additional and difficult-to-control risk to the safety of both students and staff.

C. HOW HORSES RESPOND WHEN THEY ARE STARTLED

14. Horses that receive any form of electric shock including microshocks, shocks from stray voltage, electric fencing and static shocks from rugs/blankets will elicit a startle response or spook. The Department's Code recognises this in its reference on page 5 to: "Microshocks can occur whenever a person and a conducting object almost touch under a power line and are not (by virtue of being connected to each other or both being connected to earth) at the same potential. In practice, experience has identified several common scenarios: ... person riding, leading, or touching horse or other animal ...As well as the actual physical sensation of the microshock, microshocks could in some circumstances give rise to further effects, either if the microshock causes a person to startle with dangerous consequences, or if repeated microshocks cause aversive responses to the situation that produces them."
15. This startle response of a horse is a reflex behaviour and is not under conscious control, therefore this behavioural reaction is not something that can be prevented or retrained. When a horse is startled, their sympathetic nervous system is triggered which can initiate the fear-based fight or flight response, the intensity of which will vary between individuals depending on how scared they become.
16. Starling, M., McLean, A. and McGreevy, P. (2016) describe:

"2. Causes of Dangerous Behaviour in Horses

2.1. Flight Responses

Like many animals, horses are often at their most dangerous both to themselves and to humans when highly aroused and attempting to escape perceived danger [21]. Horses are a large prey species reliant chiefly on flight at speed to keep themselves safe. This poses a problem for them in many human-horse interactions, as it is common for horses to be confined or restrained to varying degrees when around humans [22]. Being contained where the horse is worked with or housed reduces a horse's options for gaining safety. If sufficiently aroused, it may run blindly into fences or other structures, or into humans [23].

More commonly, inability to escape may pressure the animal into experimenting with confrontational behaviours such as charging, striking with hooves, and biting [24]. These behaviours are likely to meet with some success, since humans confronted by a large, aggressive animal will naturally prioritise their own safety and attempt to escape by retreating [23]. The alternative is for the human to meet confrontation with escalated aggression and intimidate the horse into withdrawal. The consequences of these actions are potentially serious. In the former scenario, the horse's aggressive behaviour is negatively reinforced by the human retreating, (i.e., this has proved a successful way for it to create the space it needs to feel safer), or to avoid an event it had anticipated and found threatening or noxious [25]. Not only is this dangerous for the human, but it probably also perpetuates heightened arousal and negative emotional states in the horse [3]. Emotional conditioning may result in humans and/or training scenarios acting as signals for horses to become aroused and avoidant, or vigilant in anticipation of negative outcomes. Such anticipation primes animals to respond more strongly to aversive stimuli [26] and to interpret ambiguous signals as more likely to be potentially threatening [23]. This is unlikely to be comfortable for the horse, and is likely to trigger further defensive, high-arousal behaviours [12]. Furthermore, behaviours that have resulted in successful avoidance of an anticipated aversive experience can quickly become entrenched and very difficult to eliminate [27]. Deviating from avoidance behaviours known to be successful increases risk, so persistent avoidance behaviours are adaptive [28]. Re-training a horse that has learned undesirable avoidance or distance-increasing behaviours may prove challenging [29].

2.2. Confusion and Conflict

A horse cannot necessarily read the intentions of its rider or trainer. There are many ways a rider or trainer's behaviour can induce confusion. For example, signals may be unclear or inconsistent, or the horse may be unaware of how to reduce pressure imposed on it, or what the consequences may be [31]. This confusion can lead to a horse becoming conflicted, with opposing motivations, such as both approach and avoidance competing to manifest as its behavioural response. Such a horse may become uncertain of which behavioural response to adopt and, if arousal is elevated, this could prompt it to experiment with inappropriate locomotory responses such as bolting, bucking, rearing or shying [32]. Such loss of predictability and controllability may render the horse increasingly insecure, repeating the cycle of conflict and further endangering the rider...

4. Conclusions

Horses can weigh more than 500 kg and are prone to strong flight responses. The danger they present when highly aroused and fixated on creating distance between themselves and perceived threats cannot be overstated. Those working with horses may inadvertently trigger flight responses, or be seen as a threat to be escaped from or driven away by horses, depending on environmental conditions such as available space or the presence of other threats...

17. A horse may show a wide range of immediate fear responses, escape behaviours, avoidance behaviours, and longer-term conditioned fear reactions which can be retained for a long time due to being a prey animal and the ability to form memories in a contextual manner.
18. The exact behavioural response in a given situation can depend on various factors, including: the intensity of the shock, memory and linked emotions from previous experiences, temperament, and whether the horse associates the shock with a specific location, object (stimulus), person, or activity.
19. Horses typically escalate their manifested behavioural fear response in response to a stressor in the following ways (see also figure 1):
- a. Stress increases when the horse receives an electric shock. Immediate fear and startle behaviours include: sudden jumping or flinching, whole-body startle response, leaping away, rushing backwards, throwing the head up, rapid head tossing, ear flicking or ears rigidly forward/backward, eyes widening and showing sclera and wrinkles above the brow, snorting and/or blowing, muscle tension throughout the body with freezing, trembling or shaking, hypervigilance (scanning the environment);
 - b. The horse will try to increase distance between themselves and the aversive stimulus if they know where it came from. With a microshock, a horse may assume it was an object/person they were near, e.g. water trough, person and then try to escape or avoid them. Escape and avoidance behaviours may include sudden stepping away, rushing backwards, spinning away, sideways leap, scooting away, rapid retreat, bolting, running blindly from the location, crashing through fences or obstacles, attempting to jump barriers. Loose horses are a high risk of causing further injury. For example, the Household Cavalry horses that were spooked by noise on a construction site in April 2024 caused riders to fall off (one broke his back) and property damage caused by horses galloping through London into a bus, other vehicles as well as into pedestrians who were hospitalised. And again, in July 2024 another 3 horses were spooked by a bus whilst being led by persons and bolted through London (Evans, 2024)



- c. If the horse cannot take flight – or flee - because they are restrained or trapped then their stress reaction cannot decrease because they are still fearful due to continued activation of the sympathetic nervous system, and so they turn from flight to a fight response, to try and remove the aversive stimulus away from their vicinity. Some of the more common fight behaviours by the horse include: chasing away, bite threat or bite, kick threat or kick, bucking, barging, trampling, striking, rearing and hoof flailing.

20. Avoidance behaviours after the shock (short and long-term) could include refusing to approach the area where they were shocked, stopping before reaching the location, increasing personal distance from the fear-inducing stimulus, leaning away, turning the head away, sidestepping away, hesitation or reluctance to move forward, refusal to approach gates, fencing, water troughs, buckets, or equipment associated with the shock, avoiding specific people present during the event, avoiding people approaching with a headcollar to be caught, avoiding turnout in certain weather conditions if shock occurred repeatedly in those conditions, avoiding electric-fencing more strongly than before.

20. Fear responses are rapidly acquired and remembered strongly by a horse as an integral part of their self-protective response as a prey animal, making them very

difficult to erase. If the horse forms a strong association between receiving a shock and any of the previously mentioned stimuli above then fear can generalise beyond the original stimulus. So, for a horse that has experienced trauma from multiple shocks, even if from different stimuli (microshock, static from rug, shock from fence, shock from handler) the horse will become sensitised and have a lower emotional threshold, meaning their behavioural reactivity is likely to be more extreme and they will have lower ability to cope with stress before reacting. These horses show conditioned (learned) fear responses which can lead to future avoidance or fear responses elicited by associated cues or contexts including spooking at similar objects, increased reactivity around fences or gates, fear of handling in a particular location, anxiety before approaching the shock-associated area, anticipatory tension, repeated stopping and scanning, elevated startle responses, hyper-reactivity to touch, increased sensitivity around the head, muzzle, or body part that contacted the source of the shock, learned helplessness in severe cases and generalised anxiety in the environment where the event occurred.

21. No single horse will show all of these behaviours, but collectively they represent the main repertoire of responses that may occur following an electric or static shock.

D. RISK OF INJURY AND REDUCED WELFARE

22. Potential injuries to handlers or riders if horses display one or more of the above behaviours may include:
- a) Being pulled, dragged or knocked over;
 - b) Being struck by the horse's head, body or hooves;
 - c) Being trampled;
 - d) Being thrown or crushed against objects; and
 - e) Falls from horses.
23. Handling horses, whether leading, riding or working with them tied up nearly always involves methods of restraint, all of which remove a large element of

control from the horse and can make them react more through their fight instinct as they are unable to flee to avoid or escape a situation.

24. Research by *Christensen* (2012) indicates that horses display greater physiological stress responses when they are led or otherwise constrained during exposure to aversive or novel stimuli than when they are free to express avoidance behaviour. Therefore, should a horse receive an unexpected microshock whilst being led by a person, the resulting reaction may be more intense due to the horse's reduced sense of control over its own flight response due to being restrained, thereby increasing the risk of sudden movements, the loss of handler control, and of injury to people nearby.
25. The risks associated with horses receiving unexpected microshocks and behaving in a manner dangerous to their human handlers is of concern at ARU Writtle, due to the continual turnover of both horses and students, as students progress year after year through their courses, with approximately half of these students being under the age of 18 and aged between 16 or above. Every year ARU Writtle intakes new students, and routinely has novice students at both FE (age 16 upwards) and HE (aged 18 upwards) handling the horses, who will have no knowledge of the individual horses they handle nor of their previous fears or experiences.
26. Understandably, students are often unable to recognise subtle signs of anxiety and avoidance in horses, meaning that if a horse reacts to a microshock in the manner described previously, students themselves are likely to react in a way to control the horse by trying and bring the horse back under their control, for example, by adding pressure to the rope or reins by which they are already controlling the horse's movement. Most people that are surprised by a scared horse's behaviour will also react instinctively themselves to that unexpected equine reaction and will typically instinctively respond by adding more pressure to the horse's headcollar or bridle to try and make the horse comply (i.e. stand still or walk calmly). The horse may find this added pressure aversive and even overwhelming, adding more stress and escalating its fear response, leading to more sudden or violent reactions from the horse and increasing the risk of injury to both person and horse. In such circumstances, it is common for the horse to be reprimanded for their unexpected reaction by their handler and even punished for

‘misbehaving’ as the genuine internal fear emotions of a horse are not recognisable by the person handling as the reason for the behaviour, thereby further compounding the fear reaction of the horse and likely causing the behaviour to intensify the next time it is triggered as the horse tries harder to successfully avoid the situation.

27. Therefore, the welfare implications are not limited to the short term event of the microshock itself, but include the risk of related resulting long-term behavioural consequences such as fear conditioning from associative and contextual learning of the horse, particularly with the relatively rapid turnover of students passing through their education process and who may inadvertently also trigger these learned fear responses and subsequently punish the horse for responding in this way. *“Punishment is associated with certain emotional states such as fear and frustration in the punished animal. Fear and anxiety can be adaptive in that they raise vigilance and promote attempts to regain control of aversive situations”* (McGreevy and McLean, 2009). In microshock cases, the unpredictability of both the aversive event and subsequent handling interactions could increase the potential for further ‘misbehaviour’, reduced welfare of the horse and increased risk of accidents and injury to all parties.

E. EQUINE PERCEPTION OF MICROSHOCKS AND CONTEXTUAL AND ASSOCIATIVE LEARNING

28. Research from *Tong et al. (2020)* demonstrates that horses possess the same basic anatomical structures required for the detection and transmission of painful stimuli as do humans. Despite having thicker skin overall, this does not insulate horses from externally applied aversive stimuli. Therefore, it is reasonable to conclude that horses are capable of perceiving microshocks as painful sensory events and may respond behaviourally in the same way that humans react to an unexpected painful electrical stimulus. Such responses may include startle, avoidance, flight, or defensive behaviours that could compromise handler safety.
29. Horses learn behaviours in the context which they experience them in. When a horse experiences the application of an aversive stimulus (e.g. an electric shock)

they may have an extreme response such as trying to run away to escape or avoid the aversive stimulus. This is negatively reinforced if the reaction stops/ delays the punishment/fear/pain meaning the horse is more likely to offer extreme reactions in the future.

30. Such a stimulus also creates powerful fear associations with the aversive stimulus, and any people or stimuli present during the shock. Fear is learned from a single response and never completely forgotten by a horse as a prey animal with a flight response embedded to ensure equine survival. Horses retain fear memories for a very long time, and even with desensitisation training the risk of relapse of the original extreme behavioural response is always possible. Whilst horses will typically try to avoid known aversive stimuli, however, the emotional trauma associated with experiencing an electric shock can have more serious long-term consequences.
31. Behavioural output is also a product of arousal and emotional valence, both of which are difficult to quantify and are relative to each individual and their perception of the aversive experience. The difference in horse's (and people's) responses to fear and pain-inducing stimuli are also shaped by past experiences and memory. Whilst we can reason with a human and explain what happened logically, this cannot be done with a horse, and their behavioural responses are largely driven by emotions, and being a prey animal they have evolved to be neophobic, risk averse and alert to any possible danger.
32. When a horse experiences an unexpected aversive event such as an electric shock from an overhead power line, learning is unlikely to be restricted to the shock itself. Through associative learning, the horse may form associations between the aversive event and other stimuli present at the time, including the person leading it, nearby environmental features, particular sounds, smells, or the location in which the event occurred. Consequently, subsequent exposure to any of these previously neutral stimuli may evoke fear, vigilance, tension, or avoidance behaviour even in the absence of further shocks. This is consistent with broader research on fear conditioning and learned helplessness, where animals learn not only about the aversive stimulus but also about the surrounding context in which it occurs.

33. *“When animals are exposed repeatedly to pain in the form of sustained, highly aversive stimuli, conditions such as experimental neurosis may escalate so that the animal loses all active control. When the highly aversive stimulus is totally inescapable, learned helplessness may set in. The important distinction here is that the animal no longer tries to cope; it gives up and becomes dull. Established learned helplessness may compromise horse welfare because an animal in this state has undergone a critical loss of control of its environment.” (McGreevy and McLean, 2009).*
34. [Solomon \(1964\)](#) (cited in McGreevy and McLean, 2009) showed that maladaptive behaviour arises when:
- “1. there are sustained raised levels of arousal;*
 - 2. the aversive stimulus is unpredictable;*
 - 3. the aversive stimulus is uncontrollable; and*
 - 4. the aversive stimulus is inescapable.”*
35. Whilst horses can learn to avoid known stimuli that have in the past shocked them, and therefore control their exposure to electric shocks in this way, they cannot do this with microshocks because of the unpredictable random nature of microshocks. For example, even new horses coming into ARU Writtle are likely to have been exposed to electric fencing and will know to avoid such fencing but will not know to avoid areas of ARU Writtle where they may experience microshocks and will have to experience these to form the new contextual associations.
36. At the time of experiencing the microshock, the horse could also in combination be noticing the person leading/handling them, auditory stimuli such as buzzing or crackling from the overhead power line, weather conditions such as rain and wind against the power line, the specific location, and any other specific equipment in the vicinity. The horse makes a reflex connection between the unpleasant experience of the shock when these sights, sounds, people and places were present. The more surprising and uncontrollable the event, the more broadly those associations may spread. Thus, what may appear as seemingly irrational and even maladaptive behavioural responses to us as human beings, such as a horse refusing to walk through a gateway even though other horses are there, or to a certain area of the field where there is lots of grass, are actually the horse’s

learned contextual responses to avoid further microshocks and consistent with its prey nature and self-protective tendencies.

F. POTENTIAL SITUATIONS OR OBJECTS IN OR BY WHICH A HORSE MAY RECEIVE A MICROSHOCK

37. This quote from the *Development near overhead lines* document (National Grid, 2008) is concerning in relation to the number of possible objects that could pick up voltage from the overhead lines and cause a microshock:

“High voltage equipment produces electric fields which can cause nearby conductive objects to acquire a charge. When discharged to earth through a person touching the object, a small microshock may be experienced. For instance, a car parked under an overhead line can pick up a voltage and when a person touches it, a small spark may occur between the car and that person. Microshocks may sometimes be annoying, but are not normally regarded as dangerous or a health risk. Metal-clad buildings and metal fences under overhead lines can similarly pick up a voltage. These should be appropriately earthed to reduce the effect of such voltages. Magnetic fields from power cables and overhead lines can also induce voltages on conductive services, such as pipelines or telecommunication cables, that run parallel and close by.”

38. Below the proposed line of the overhead power lines, Figure 1 of the NGET Response shows paddock boundaries. These boundaries are electrified metal fencing on all field boundaries, metal water troughs, and metal gates.
39. There is also a public footpath that crosses this fencing on the west boundary of field 8 as shown on the Field Map annexed to this Opinion.
40. The ARU Writtle horses customarily wear various items when in the fields that have metal components that include rugs, headcollars, muzzles, fly sheets, boots, masks. Most of the ARU Writtle horses making up the ARU herd are shod with steel shoes also. In the context of microshocks, headcollars are more of an issue for horses because their heads are more sensitive and the metal buckles sit on the face nearer to nerves of the horse.

41. Shod horses – metal shoes improve conductivity and grounding and therefore shocks are more noticeable. *“It is believed the fact that the horse has four legs grounded at any one time rather than two – and often while wearing steel horseshoes – allows it to conduct electricity more freely.”* (Reynolds, 2011) Horses wearing metal shoes are more susceptible to receive shocks if there is current to pick up, and may leap in the air (Boatwright, 2023)
42. Students and staff are also likely to be wearing items containing metal and are also at risk of microshock.

G. CASES AND EXAMPLES OF BEHAVIORAL REACTIONS

43. I set out below a series of examples of the reactions of horses to stimuli and that show a real consistency, as well as reports:

1) Power Lines and Pylons

43. From a national equestrian magazine's online forum Riding under pylons - horse affected by electricity? | Horse and Hound Forum (2013) describes:

- a) *“Have recently moved to a new yard, and the sandschool is situated directly under overhead power cables, and one end is only about 40m from the pylon. When there is moisture in the air the electricity buzzes and crackles quite loudly.*
- My mare is a fizzy little excitable type anyway, and has always had days when she wants to do everything at the speed of light with her head in my face (yay) but usually she will settle after about 20 mins and work properly. Since we have been at this yard there have been a few days where she just doesn't settle at all, and seems completely wired - different from ever before.*
- b) *I have a gelding on my yard that is worried by Electric pylons. He becomes spooky when it has been raining and we ride either along the line or under it.*
- c) *We have lived on our farm 18 years now and we are directly under over head electric cables and our school is bang next to a pylon, it's buzzes and crackles when it's going to rain and when it's raining and in damp weather. Yes it definitely fizzes some horses up, we have a livery yard and it affects all different horses differently but we are also on top of a hill and it's always windy too. One*

horse freaked out and bolted straight through a dry stone wall with its rider which was quite nasty and they can be sharp when bringing in from the field. I bought my boy a set of those MoJo things that are supposed to deflect outside energies, I find these help but it could all be in my mind lol. Also I haven't lived there now for about 5 years but I always had head aches there and I'm sure it affects your health living so close to a pylon, I'm much better now I don't live there, I would never buy a property with a pylon close to the house. Sometimes when it's windy the electric wires hit each other and make a loud bleeping noise and that can really upset them.

- d) There is a very good competing venue called Weston Lawns in Warks which has pylons over head. So many people from all over the place compete here and many have said it definately affects their horses. You can hear the crackling whenever its damp, drizzle, rain, sleet and snow. Some horses react as though they get little electric shocks from the ground through their shoes, (a bonus if your doing dressage!!) Other horses don't seem to be bothered by it, so i suppose it depends on your horse. A bit like us when we get electric shocks from other people, some get them more than others. I think once your horse gets used to it they will settle down.*
- e) I used to keep my horse at a yard where there were several electrical pylons over the pastures. If you went under the wires with bare feet, you could feel very light zaps running on your skin, and horses avoided them.”*

44. The noise that powerlines and pylons can make is well documented in more of the cases further on and clearly explained in the [Development near overhead lines 0.pdf](#) document (2008): “Noise from energised overhead lines is produced by a phenomenon known as “corona discharge” (a limited electrical breakdown of the air). While conductors are designed and constructed to minimise corona discharge, surface irregularities caused by damage, insects, raindrops or pollution may locally enhance the electric field strength sufficiently for corona discharges to occur. This can be audible in certain conditions as a “crackling” sound, occasionally accompanied by a low frequency hum. The noise level generated by a high voltage overhead line is weather-related, with highest noise levels occurring during damp conditions.” It is likely that horses will make associations with these

sounds and microshocks and therefore are reactive in the future when they just hear the noise.

45. From an equine behaviourist in Canada: *“An incident involving overhead power lines where a group of horses became extremely spooked on a trail ride under overhead wires and seriously injured a rider.”*
46. From a riding coach and competitor: *“My horse is extremely reactive to the clicking noise of an electric fence. So, for example, when I turn the electric off to go in and poo pick, he will sniff the fencing and then if he is standing by it when I leave and turn the energiser back on, if he is still stood near it, he will jump and run away from it. I imagine he would go into orbit if he actually got zapped by it! As a result, he is wary of electric fencing and will not get too close. Those pylons are bloody noisy as well! I have problems with him when I go to Downhouse because they have pylons that run over the top of the XC [cross country] course and it really affects him! Yeah, he goes extremely tense, its like I can feel the fight or flight mode kick in. His head shoots up and he tucks his bum right under. I can clearly tell (and feel) that he is negatively affected by it.”*
47. From an equine behaviourist in Canada: *“I have seen horses that have been shocked from overhead powerlines when they are being ridden underneath them, particularly when they are wearing any metal tack, for example bits in the mouth and metal buckles on the bridle which do deliver shocks to them. And I have personally ridden horses under power lines and experienced shocks.”*
48. ARU Survey: Preliminary responses from an ongoing survey (launched June 2026) conducted by Professor Roberta Blake at ARU involving a survey to equestrians in the UK has returned responses from people reporting their horses displaying unusual behaviour within 50-100 metres of electricity pylons and overhead wires. Behaviours were described as mild, moderate and severe. The most commonly reported responses were increased tension, head tossing, repeated avoidance, and spooking. Less common responses included sudden stopping, reluctance to graze nearby, and single reports of bolting, rearing, bucking, aggression, tail clamping, trembling, and refusal to move forward.
49. Some horses displayed these behaviours for the first time, others had behaved this way previously. Participants reported that the behaviour stopped either

immediately after leaving the vicinity of the pylons and wires, or only diminished gradually as they left the area. 4/7 riders reported that they actually experienced the manifestation of safety risks as follows:

- a) *“We were on a road where the pylons crossed. The pylons make much louder noise in wet weather or when cold enough to be frosty, and in high wind. The noise makes my horse spooky and tense. If I was to meet traffic at the point on those occasions this would be a safety risk for my horse spooking into traffic.*
- b) *Being thrown off from the horse and horse escaping the area*
- c) *By her bucking rearing I was concerned I’d either be thrown off or if a young child was to try and ride her they’d get Hurt. Her bolting meant I thought she’d run straight through the fence and hurt herself. She only would start doing it as soon as she heard the noise from the overhead wires and the pylons. I think it also made her feel really distressed*
- d) *My horse always used to get tense and snort loudly at exactly the same two points on a bridleway, both of which were directly underneath power lines. Although luckily nothing ever caused her to spook badly here, she was clearly stressed at these two points on the ride, which was an increased risk to us both, as well as to any other bridleway users.”*

50. Other comments from the survey participants included:

- a) *“Increased noise at the pylons is always noticed in wet weather (rain, snow or frost) or high wind, and my horse reacts to them on those occasions
At the XC [cross country] course I go to they have large pylons and my horse does not like to go near them, they always misbehave out of character when nearby and act very tense
As soon as we rode away from the infrastructure she was fine but when she heard the noise she hated it”*

2) Electric Fencing

51. My observations: a horse received an electric shock from a human touching electrified fencing whilst holding onto the horse have resulted in the handler being dragged across the field by the horse pulling back from the shock and running

away and the handler not letting go. The horse then displayed avoidance behaviour towards the individual who shocked them, snorting and striking out with a foreleg to kick to prevent the person coming closer and touching them again. This took a long time to resolve as the horse had experienced both the shock and the discomfort from the handler holding on to them and they had to be desensitised to having that person approach, putting a headcollar on, walking near fencing and through gateways. I have also seen a horse receive a shock from a person touching a fence without realising, the horse spun around and took off galloping away from them across the field, knocking the person back into the electric fence where they were shocked again until they could stand up and move away.

52. In the following video screenshots (@MrArneee, 2026) you can see the reaction from a horse who receives a shock from a human from electric fencing which is typically set to between 2-5kV/m for horses



The leap backwards is a mild reaction but is enough to knock over another student who could be following with a horse behind or upset a following horse and make them jump out of the way and possibly collide with another horse.

53. An example of a moderate response during which a person could easily be knocked over and trampled, and other horses are startled (Annon1602, 2025):



Horse touches fence, receives shock, leaps forward, surrounding 3 horses also react and move

54. Severe response In these 2 screenshots from Sausagesoxandsteveo (2024)



the horse leaps away when shocked then gallops off, with the other horse following and is seen leaping in the air and kicking out which could set off horses in neighbouring fields, the outdoor arena, etc. This has the potential to cause injury as the horse is panicking in flight mode, meaning they are more likely to run through fencing, people and other objects in their way as their survival instinct has taken over. Whilst the video shows that the horse has conductive tape wrapped through his headcollar, the same effect could be achieved by a horse receiving electric shock to the metal components of a headcollar around their head and grazing muzzle which some of our horses wear in the summer months.

“The electric fence is not only a positive punisher but also a highly aversive punisher that may register as such a serious punitive event that an animal will scarcely venture to touch it a second time. As a punishing stimulus, an electric fence at least offers some controllability in the sense that the horse actively chooses to move away and release itself from the aversive stimulus. Compare this with an electric shock collar where the controls are in human hands. The animal has diminished controllability and is at the mercy of the skill and mood of a human. For this reason, many countries have outlawed the use of electric shock collars” (McGreevy and McLean, 2009).

55. From an equine nutritionist in Suffolk: *“I had a client with an issue where the yard owner had put in new electric fencing (mains) and had buried [electrical lines] under gateways but it perhaps wasn't insulated/buried deep enough and they had subsequent issues with turning out as their horses would no longer go through the gate way and then if they got them in (usually bolting/rushing through said gateway) the horses would be unsettled. It caused weight loss in this horse (why I was involved) as it wasn't grazing as it used to due to stress. There was significant risk to owners getting crushed/squashed as they tried to avoid going through the gate way or rushed through.”*
56. From an equine behaviourist in Suffolk: *“Horse that received repeated shocks from being caught in electric fencing in a gateway was petrified and developed a generalised panic of all gateways. Took months to desensitise the horse to be able to walk through gates into fields. There were very real safety implications of handling him, due to his extreme flight response to gateways (which took us months of baby steps to overcome). There was also the obvious welfare that he had a period of time where he couldn't be turned out, due to this.”*
57. From an equine behaviourist in Wales: *“Electric fencing around menage down a narrow path to the paddock, horse ended up getting shocked by it. Spun and bolted away from handler, handler ended up getting kicked in the process and had a nasty haematoma on their leg. Horse then became extremely difficult to get to the paddock even with the fencing off, and it being removed. Struggled with narrow spaces and it seriously damaged the horse-human relationship and impacted welfare as the horse spent more time in the stable.”*
58. From an equine behaviourist in Canada: *“I have seen horses that have experienced trauma from being caught in electric fencing, or from being unable to*

escape the aversive. I've seen strong fear responses, horses run through fences, people be pushed over. These challenges can be really difficult to overcome."

59. From an equine vet nurse: *"I often encounter horses at work who are worried by the clicking or visual aspect of electric fencing, clearly having also had a negative experience towards this."* This would be similar to horses associating the sounds emitted by power lines and the nearby pylons with receiving microshocks and becoming anxious when they hear them.
60. From a rider: *"I had an incident with my horse about 5 years ago where he got cornered by another horse and ran through electric fencing. I was attached to him so this resulted in us both getting shocked, he bolted and I got knocked over. After this he was petrified of the gateway of his field and any electric that would click. We're now at a different yard and he's a lot better but he is often still worried if we hack past any clicking electric."* This is directly relatable to the sound association horses could make with the power lines and pylons and receiving microshocks.

3) Static from Rugs on Horses

61. A horse can receive microshocks from other items than overhead or below ground cables such as from rugs. These different sources of microshocks show the consistent reaction of a horse to an electric static shock.
62. My observations: I have seen a horse receive a static shock. It resulted from taking a rug that had static off from one horse, which the handler did not realise, then approaching another horse and moving their hand to stroke the horse's nose, which hand movement conducted the static and shocked both the horse and human. The horse pulled back, panicked because he was restrained by its handler, broke away from the tie ring and galloped away with the lead rope trailing between his legs (high risk factor for trip injury). This startled the other horses in the vicinity and several people were working closely with horses that suddenly startled. The contagion effect in horses is well documented, as they are a social prey species and rely on being alert to nearby horses to be alert to potential threats. If this were to happen with several students in a field all leading horses, several horses could become upset and triggered by an escaped horse, putting everyone in danger. The bolting horse is a risk to anybody that is in its path. Also,

the risk of injury to horses from pulling back is another factor to consider and that may increase the trauma experienced from the shock by adding this pain experience to that of the shock, making the effects longer lasting and more likely to resurface.

63. Several behaviour colleagues with whom I have spoken have provided further evidence by means of anecdotes of horses receiving static shocks from rugs and displaying avoidance behaviour, aggression to being rugged (biting and kicking), quick movements away from handlers which may knock them over, running through people, and generalised fear of being approached by rugs, hearing Velcro straps being pulled apart (commonly seen on hoods attached to rugs).
64. From veterinary behaviourist Dr Sue McDonnell in the USA: *“A 7-year-old Thoroughbred mare who, for the past two years, beginning in late October, would become frantic before morning turnout. Her owner reported that she would weave, chew wood, resist leaving the barn, become difficult to release, run to the corner of her pasture, and tremble. She was also nervous and nippy during grooming and tacking. This would last through late spring, when the behavior issues disappeared until the following October. The veterinarians considered performing an ovariectomy. But after a careful behavior evaluation, they determined the root cause of her behavior was static electricity. She was extremely static-electricity-sensitive, which coincided with the months of the year she wore a blanket.”* (Beckstett, 2018)
65. From an equine behaviourist in Wales: *“Horse became difficult to rug due to static shocks, same when going to touch the horse or groom them. Horse had PSSM so rugging was essential to keeping them comfortable. Damage to horse-human relationship as the human ended up becoming a bit of a predictor of a negative experience when carrying out husbandry tasks to keep their horse comfortable. Horse escalated to bite threats during rugging and grooming (largely due to PSSM and touch sensitivity, just not helped by the static shocks). Pylons were in the vicinity but not directly in their field.”*

4) Stray Voltage

66. There are multiple cases online reporting horses avoiding water troughs after stray voltage shocks including the article by Boatwright (2023). Electric shock from

water troughs will cause horses to avoid the trough and therefore decrease water consumption. Reduced water consumption leads to dehydration and serious health complications in horses. Mild colic may be observed at 5% dehydration and severe colic at 12% dehydration (Menzies-Gow, 2016) which can be life-threatening.

67. From an equine behaviourist in Canada: *“I have seen several cases of horses that developed strong fears of water tanks in which de-icers had been put in them and had shorted. The horses then became frightened to drink. It takes a considerable amount of time to overcome, with a strong risk of relapse should anything negative be associated with the water tank again. They have to use de-icers in winter and horses associate the onset of cold weather and snow with the trauma of the shock and start avoiding drinking from the trough in those conditions. I also had a horse who developed a fear of the mat in a stall because there was some stray voltage from electric fencing under the mat with the feed on it and the horse became afraid of that area of the stall.”*

68. Horses that have been punished with electric equipment such as spurs, whips and cattle prods can become hyper-reactive, showing unpredictable and dangerous behaviour. Or they can become emotionally shutdown and enter learned helplessness as they know they cannot escape the aversive stimulus as their avoidance attempts have not worked.

Possible Foreseeable Scenarios Involving Microshocks at ARU Writtle

69. Horses make memories by associating different elements of a stimulus with emotions and physical sensations. Thus, if a horse receives a microshock from a power line/pylon it will make memories of anything else that was happening at that time. Possible scenarios could include:

a) An ARU Writtle student (between the ages of 16 and upwards) goes to catch a horse in a paddock in the North-West of the educational establishment and as they touch the horse to put on the headcollar a shock occurs between them both. The horse spooks and pulls away from its handler. The horse will remember the memory of the handler reaching towards their face and avoid

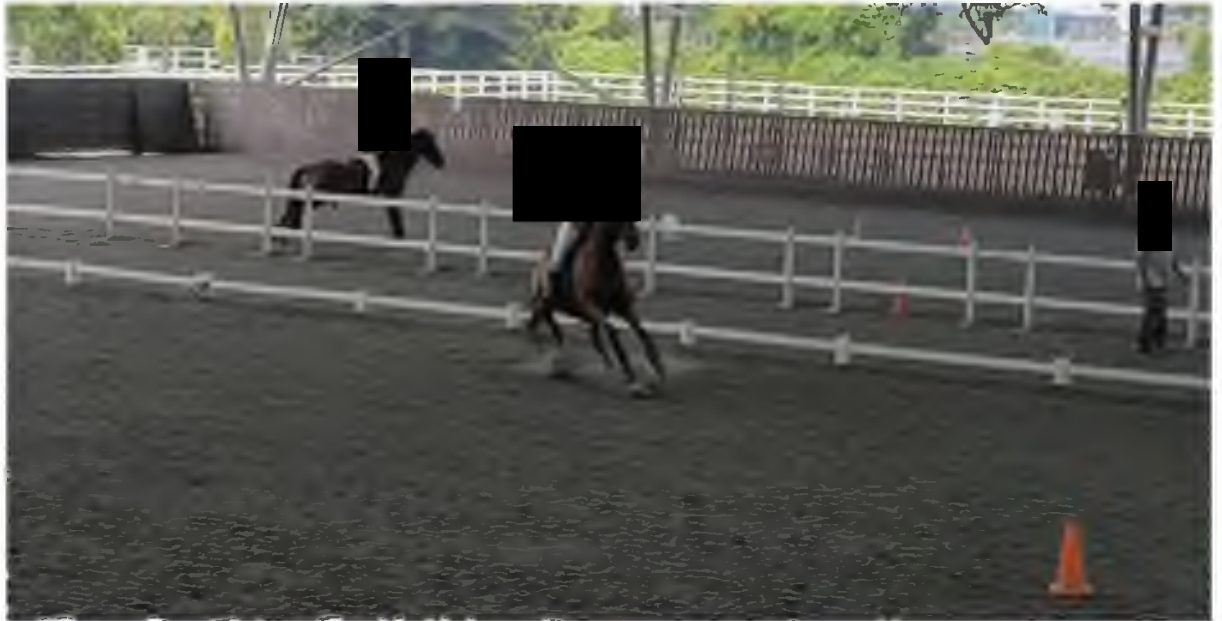
this reaching action in future as a result of the painful association. The horse will view also the headcollar as the potential cause of shock. The horse will remember where it was and avoid the location. It will associate the clothing and that the student was wearing and may generalise this memory to other people wearing similar attire.

- b) A horse is being led through a North-Western paddock by an ARU Writtle student (between the ages of 16 and upwards) on a windy day and as they pass beneath the pylons the horse receives a microshock, jumps sideways and is anxious. They concurrently hear the buzz/hum of the power lines or the crackle of micro-sparks, or the Aeolian noise (singing) that power lines can produce in high winds. The horse may now anticipate microshocks in windy conditions or when they hear the noise from the powerlines and show anxiety when they hear these sounds, or sounds similar to them such as clippers running (used for shaving horses in autumn and winter and sometimes for veterinary procedures) and react negatively.
- c) An ARU Writtle student (between the ages of 16 and upwards) goes out to adjust a rug that has slipped on a horse standing under the power lines. As they reach under the horse's belly to grasp the strap and do up the buckle the horse receives a microshock, startles violently and kicks out at their belly catching the student's upper body or head. The horse may now be averse to having rugs put on or taken off, people reaching underneath them (grooming, doing up a saddle, applying medical treatment, etc.), having rugs brought near them and may show aggressive responses as they are usually restrained in these situations and cannot flee so will fight. The horse is also likely to avoid this location and the person carrying out the task.
- d) A horse receives a microshock when drinking from the water trough below the power lines that is positioned in field 8 (as shown on the Field Map annexed) The horse may now associate the water trough, drinking behaviour, the location, the sound of electricity overhead, any water source with the potential of receiving further shocks. As a result the horse may avoid drinking from that trough and generalise this to other water troughs and water receptacles, increasing the risk of dehydration.

- e) A Pony Club camp is using ARU Writtle facilities and set up riding activities in the fields. A horse receives a microshock with makes them leap, the rider himself or herself instinctively reacts by pulling the reins to keep their own balance on the back of the horse, jabbing the horse in the mouth and resulting in the horse reacting more strongly to avoid the discomfort in their mouth, especially and the more so if the initial microshock they received was through the metal bit in their mouth. The rider could become unseated, fall off and injure themselves, be trampled by the horse, and now the horse is loose, scared and running around upsetting the other horses in the riding session. Examples of similar scenarios can be seen here: [Totallrecallvideos \(2020\)](#)



where in image 1 the horse has bolted after unseating the rider in red, jumps into the track where other riders are causing another person to jump out of the way to avoid collision; in image 2 the grey bolting horse is now causing the brown horse to panic and in image 3 the flight response is triggered in the brown horse who is unable to escape and can be seen in image 4 trying to pull away from the handler. and here from horseygal (2016): the horse is quite relaxed until 1.18 when it is startled by other loose horses (1)



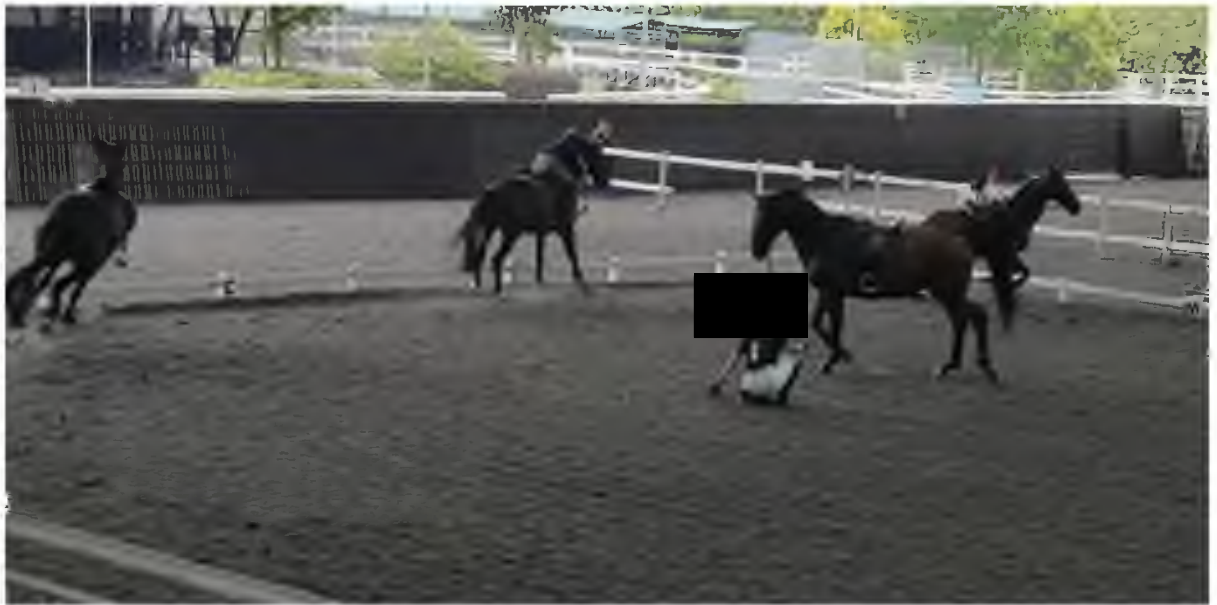
the loose horses come closer and the horse leaping away unseats the rider (2)



the rider falls to the floor and is nearly trampled, while the other horses continue to run around out of control (3)



and the remaining rider is also unseated due to the erratic movements of the incoming bolting horse (4)



- f) If a horse gets shocked when being led through a metal gateway it is likely to cause anxiety and the horse could refuse, rear, charge through crushing the handler, bolt and cause rope burn, drag, knock the handler over, etc.

G. OTHER CONCERNS

43. The installation of the pylons and overhead lines may cause serious disruption to the horse's routine and restrict their opportunity to spend time in the fields. This

will have a big impact on their welfare, as horses need to have time out of their stables to meet their behavioural and physiological needs.

44. Horses that are confined for too long in stables are also more likely to show rebound and abnormal behaviour that could cause injury to themselves and handlers.
45. Animal welfare research has identified three significant requirements of equine welfare: unrestricted access to forage; movement; and companionship with conspecifics (*Phelipon et al. 2024*), all of which require horses to be able to access fields. These significant requirements have also been described as the 3Fs (or friends, forage and freedom) and are now widely referred to by major welfare organisations including World Horse Welfare (2026) the Royall Society for the Protection of Animals (RSPCA) and the National Equine Welfare Council (2025), and the British Horse Society (2026).

H. CONCLUSIONS

46. As a behaviourist, it is my expert opinion that a situation in which horses may be exposed to unpredictable and uncontrollable microshocks should be regarded as a significant welfare and safety concern for the horse and would foreseeably at ARU Writtle have further consequences. The potential consequences extend beyond the immediate event and include adverse behavioural conditioning, compromised welfare, increased management difficulties, heightened risk of accidents, and a greater likelihood of injury within an environment that already presents inherent risks due to the continual turnover of student and inexperienced handlers and learners at ARU Writtle.

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Object habituation in horses: The effect of voluntary versus negatively reinforced approach to frightening stimuli

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Summary

Reasons for performing the study: The ability of horses to habituate to novel objects influences safety in the horse–human relationship. However, the effectiveness of different habituation techniques has not been investigated in detail.

Objectives: 1) To investigate whether horses show increased stress responses when negatively reinforced to approach novel objects, compared with horses allowed to voluntarily explore the objects and 2) whether a negatively reinforced approach facilitates object habituation.

Methods: Twenty-two 2–3-year-old Danish Warmblood geldings were included. Half of the horses (NR group) were negatively reinforced by a familiar human handler to approach a collection of novel objects in a test arena. The other half were individually released in the arena and were free to explore the objects (VOL group). On the next day, the horses were exposed to the objects again without a human handler, to investigate the rate of habituation. Behavioural and heart rate responses were recorded.

Results: All VOL horses initially avoided the unknown objects, whereas the handler was able to get all NR horses to approach and stand next to the objects within the first 2 min session. The NR horses had a significantly longer duration of alertness and a higher max heart rate in the first session. On the next day, however, NR horses spent significantly less time investigating the objects and had a shorter latency to approach a feed container, placed next to the objects, indicating increased habituation.

Conclusion: A negatively reinforced approach to novel objects increases stress responses during the initial exposure but facilitates habituation in young horses.

Potential relevance: Although a negatively reinforced approach appears beneficial for habituation, the procedure should be carefully managed due to increased stress responses in the horse, which may constitute a safety risk. Further experiments should aim to investigate differences in stimulus intensity.

Keywords: horse; fear; habituation; learning; negative reinforcement; stress

Introduction

Fear and avoidance reactions are generally unwanted in domestic horses and the ability of horses to habituate to otherwise frightening stimuli greatly increases safety in the horse–human relationship. Several different techniques have been suggested for habituation training of horses and, under certain conditions, preventing animals from avoiding aversive stimuli has been found to facilitate habituation [1,2]. Animals prevented from showing desired behavioural responses may, however, experience a loss of control, which is known to be a cause of elevated glucocorticoid concentrations [3,4]. It has been suggested that the impact of a specific stressor depends on whether the animal can perform any adaptable response to escape it or must merely endure it [5]. For example, the possibility of moving has been suggested to correspond to an active behavioural coping strategy, which leads to a decrease of the hypothalamic–pituitary–adrenal (HPA) axis arousal in a range of animals during exposure to frightening stimuli [6]. On the other hand, McLean [2] suggested that expression of fear inhibits habituation as the fleeing behaviour will be reinforced through negative reinforcement (i.e. the distance to the frightening stimulus will increase). However, preventing horses from showing fear responses can be dangerous, especially if stress levels rise above a certain threshold and the handler is unable to control the horse. Such situations can constitute a serious safety risk for the handler.

One habituation technique, which can include prevention of avoidance responses, is ‘overshadowing’ where 2 signals of different intensity are applied together, such that only the most intense will result in a conditioned response whereas the response normally elicited by the perceived weaker stimulus diminishes [2]. If a human encourages an animal to approach a frightening stimulus, it can be argued that the human signals ‘overshadows’ the frightening stimulus if the animal really does approach, whereas if the animal flees, the frightening stimulus ‘overshadows’ the human signals. ‘Overshadowing’ has been successfully applied in combination with gradual habituation for retraining of horses with behavioural problems [2]. In normal young horses, however, habituation to mildly frightening stimuli, such as novel objects, can also occur through a voluntary approach [7]. If horses are able to gather sufficient information for object habituation without being forced to stand close to the objects, this would potentially be

a less stressful and safer procedure, compared with habituation techniques which require close interaction with a handler.

This experiment aimed to investigate whether it is beneficial in terms of habituation to prevent young horses from showing avoidance responses towards novel objects through negatively reinforced approach or whether habituation occurs as readily through a voluntary approach.

It was hypothesised that horses would show increased stress responses, reflected in increased sympathetic activity, when encouraged to approach frightening objects through negative reinforcement, compared with horses free to explore the objects. It was further hypothesised that for habituation to stationary novel objects in a familiar arena, a voluntary approach would be as efficient as a negatively reinforced approach.

Materials and methods

The study was carried out in October 2010 and conformed to the ‘Guidelines for ethical treatment of animals in applied animal behaviour and welfare research’ by the ethics board of the International Society of Applied Ethology (<http://www.applied-ethology.org>).

Animals and management

Twenty-two Danish Warmblood geldings (sixteen 3-year-olds and six 2-year-olds) were used. The horses arrived at the research institute 3.5 months prior to the study and were pastured together day and night with free access to water, minerals and hay (available *ad libitum* in 2 feeding houses; 200 × 300 cm, 14 feeding places/house) as well as vegetation in an 8 ha pasture. The horses came from 8 private studs (2–8 horses per stud) and had been handled only for routine management at each stud. Upon arrival, the horses were habituated to halters and leading (including moving forwards in response to gentle whip tapping on the shoulder) as well as to wearing an elastic girth with heart rate equipment. Subsequently, the horses were habituated to social isolation in a closed, indoor test arena while feeding from a feed container (with rolled oats and molasses; a highly palatable food for all the horses), placed in the middle of the arena. A horse was considered habituated when it voluntarily entered the test arena, walked directly to the feed container and fed for at least 100 of 120 s. The initial handling and habituation to social isolation lasted 1.5 months.

Test environment

The experiment was carried out in a closed indoor test arena (10 × 10 m) in a separate room in one end of a stable. Another part of the stable was used as a waiting area (18 × 4 m) where hay was available *ad libitum*. At least 2 other horses were present in the waiting area during testing and the test horse always returned to visual contact with these horses between test sessions. Next to the test arena was a corridor, separated from the arena by horizontal bars. The same observer was present in this corridor during the initial habituation and during testing (Fig 1). For the experiment, 2 feed containers were placed 8 m apart and 6 colourful, open umbrellas were placed in a semi-circle around one of the containers. During the post test on the subsequent day, the feed container without umbrellas (container B in Fig 1) was removed.

Baseline test and treatments

One month prior to the experiment, the horses were exposed to a baseline test in which their responses towards a single novel object were measured. The object (purple rubber ball, 65 cm in diameter) was placed next to the feed container in the familiar arena and each horse was free to explore the object (2 min) while behavioural and heart rate reactions were recorded. The horses were subsequently assigned to one of 2 groups, balanced according to their reactions in the baseline test and the groups randomly assigned as either the negative reinforcement group (NR group) or the voluntary group (VOL group).

On the first test day, a known human handler – the same for all horses – led each horse to the arena entrance. Horses in the NR group were encouraged to approach container A (with objects) through pressure in the rope and halter as well as gentle whip tapping on the shoulder. Pressure was released immediately when the horse stepped forwards, whereas pressure was kept at the same level regardless of whether the horse was motionless or stepped backwards. When the horse was next to the objects it was allowed to feed from the container, i.e. it was positively reinforced for staying next to the objects. Horses in the VOL group were released in the entrance to the test arena and the handler proceeded slowly to container A, where she stood quietly during the 2 min test time. Thus the final position of the handler was the same in the 2 treatments, but horses in the VOL group were free to show avoidance responses towards the novel objects.

The procedure was repeated 3 times (Sessions 1–3) on the first test day; the test time was 2 min in the first session and 1 min in Sessions 2 and 3. On the next day, a post test was performed (Session 4; 2 min) during which feed container B (Fig 1) was removed, ensuring that the horses had to approach the objects in order to obtain food. There were no handlers in the arena for Session 4.

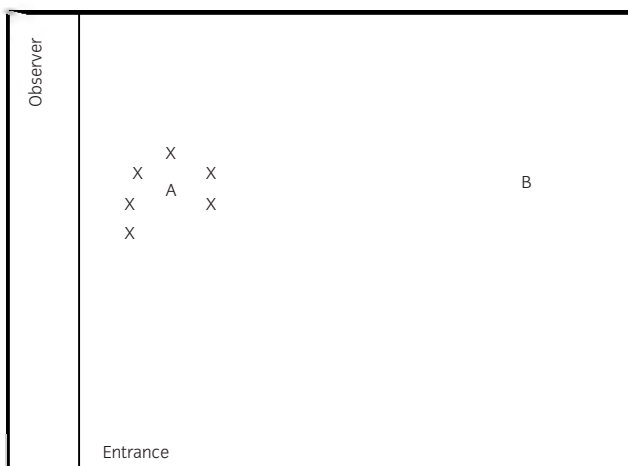


Fig 1: Test arena (10 × 10 m) and set-up during the test. X: Umbrella; A, B: Feed containers. Horses in the voluntary group were released in the entrance, while horses in the negatively reinforced group were encouraged to approach container A. In the post test, feed container B was removed.

TABLE 1: Ethogram of behaviours

Behaviour	Description
Duration (s)	
Eating	Standing by container A or B and chewing food; including lifting the head from the container while chewing continues.
Investigate objects	Approaching objects or standing with lowered head and ears pointing forwards, focusing on objects; includes sniffing and touching of the objects.
Alert towards objects	Standing, walking or trotting with elevated neck, typically with tail elevation, head and ears oriented towards objects.
Other	Behaviours not included above, e.g. focusing on other stimuli, such as sounds from outside, standing or walking relaxed without focus on objects.
Frequency	
Defaecation	Elimination of faeces.
Snort	Short powerful exhalation from nostrils.
Paw bout	Striking the ground or air with forelimb; pawing after pauses of more than 5 s was recorded as a new bout.

Data collection

In all sessions, behaviour (Table 1) and latency to eat were recorded through direct observation using a handheld computer (Workabout)^a. Subsequently, data were transferred to a personal computer (PC) and frequencies, durations and latencies were calculated using SAS 9.1^b.

Heart rate (HR) was recorded with Polar Equine RS800^c, which consisted of an Equine Wearlink and a W.I.N.D. transmitter and wristwatch receiver. Water and gel were used to optimise the contact between electrode and skin. The HR monitoring equipment was fitted on the horse in the waiting area prior to testing and the receiver stored data from the transmitter (R-R recordings). Data were subsequently downloaded via a Polar Interface to a PC, using the software Polar ProTrainer, Equine edition, 5. The average HR (HR avg) and maximum HR (HR max) during the test sessions were determined for each horse.

Data analysis

Behavioural reactions and HR in the baseline test were analysed in a *t* test to ensure that the treatment groups were appropriately balanced prior to the experiment. The response variables (HR max and avg; latency to eat; duration of eating, alertness and object investigation) were analysed for an effect of treatment (NR vs. VOL) and session (1–4) in a 2-way repeated measures ANOVA (SigmaPlot11)^d. *Post hoc* analysis was performed via the Holm–Sidak method. Furthermore, correlations between behaviour and HR variables were analysed using the Spearman rank order correlation (SigmaPlot11)^d.

All horses ate within the test time, except one horse from the VOL group in the post test; the test time for this horse was extended from 120 to 200 s after which it was censored. The latency for this horse was set to 200 s. Pawing occurred only in 2 horses and there were no defaecations. Snorting was shown by 10 horses (6 NR horses [16 snorts in total] and 4 VOL horses [5 snorts]) and occurred only in session 1 (NR horses) and 4 (VOL horses). Due to the low occurrence these data were not included in the analysis.

Results

Baseline test

The maximum HR responses in the baseline test were (beats/min, mean ± s.e.) 88 ± 3.5 (NR) and 88 ± 5.6 (VOL; *t*₂₀ = -0.06, *P* = 0.96) and mean HR was 61 ± 2.1 (NR) and 65 ± 3.4 (VOL; *t*₂₀ = -1.19, *P* = 0.25). The latency to eat was (s, mean ± s.e.) 22 ± 6.6 (NR) and 26 ± 9.0 (VOL; *t*₂₀ = -0.34, *P* = 0.74). This suggests that the treatment groups were appropriately balanced.

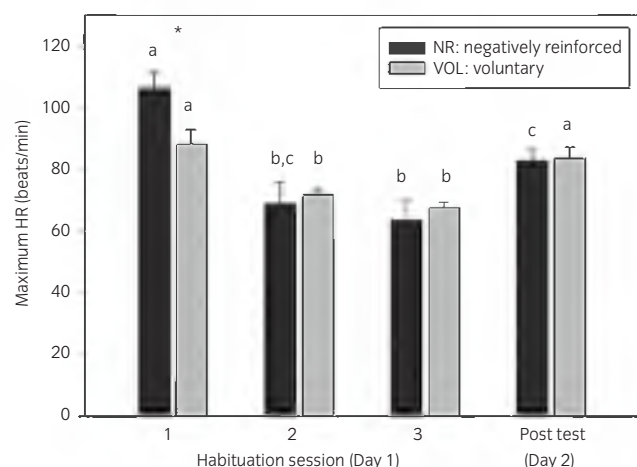


Fig 2: Maximum heart rate (HR) (mean $\pm$ s.e.) of the horses in each session. Different letters indicate significant differences within treatments, whereas asterisks indicate significant differences between treatment groups within a session.

Test results

The handler was able to get all horses in the NR group to approach the objects and feed from container A in the first session (i.e. within 2 min). In the VOL group, all horses initially avoided the unknown objects and ate from feed container B. However, 2 horses later approached and sniffed the objects after which they ate from container A. In the 2 subsequent sessions, all horses in the VOL group fed from container B.

The highest HR response in the first session was 138 beats/min (NR horse) and the lowest 71 beats/min (VOL horse), reflecting that the objects were perceived as mildly frightening. There were significant interactions between treatment and session for HR max ($P = 0.021$; Fig 2), object investigation ($P = 0.005$; Fig 3) and a tendency for the duration of eating ($P = 0.058$). For the other response variables, there was an overall significant effect of session (HR avg: $P = 0.003$; duration of alertness: $P < 0.001$; latency to eat: $P < 0.001$; Fig 4). The *post hoc* analysis revealed that horses in the NR group had a significantly higher max HR in the first session (Fig 2) and a longer duration of alertness (s, mean $\pm$ s.e.: NR: 23 ± 4.1 vs. VOL: 16 ± 4.7 , $P = 0.026$). In the post test, the NR horses spent significantly less time investigating the objects (Fig 3), had a shorter latency to approach the feed container, placed next to the objects (Fig 4) and a correspondingly increased eating duration (NR: 64.6 ± 6.3 vs. VOL: 45.5 ± 6.4 , $P = 0.003$).

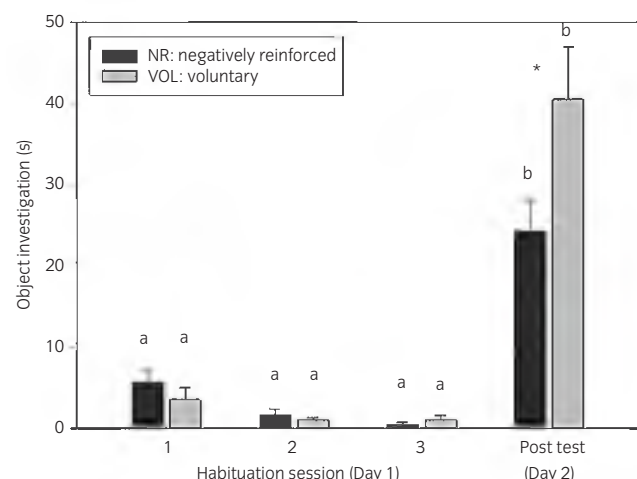


Fig 3: Duration of object investigation (mean $\pm$ s.e.) in each session. Different letters indicate significant differences within treatments, whereas asterisks indicate significant differences between treatment groups within a session.

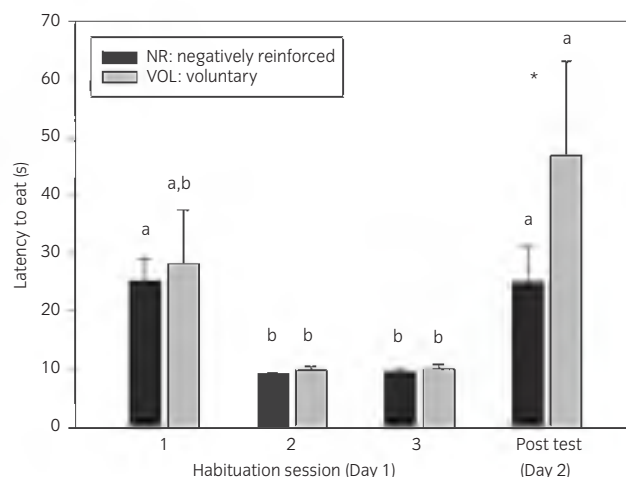


Fig 4: Latency to eat (mean $\pm$ s.e.) in each session. Different letters indicate significant differences within treatments, whereas asterisks indicate significant differences between treatment groups within a session.

Correlations between behaviour and HR variables were analysed for Sessions 1 and 4. In Session 1, HR correlated significantly to the latency to eat (HR avg: $r_s = 0.76$, $P < 0.001$; HR max: $r_s = 0.57$, $P = 0.006$), to eating duration (HR avg: $r_s = -0.62$, $P = 0.002$; HR max: $r_s = -0.49$, $P = 0.020$) and alertness (HR avg: $r_s = 0.78$, $P < 0.001$; HR max: $r_s = 0.72$, $P < 0.001$), whereas object investigation, shown by only 14 horses for a short duration, did not correlate to HR responses. In Session 4, HR correlated significantly to eating latency (HR avg: $r_s = 0.60$, $P = 0.004$; HR max: $r_s = 0.52$, $P = 0.014$) and duration of object investigation (HR avg: $r_s = 0.66$, $P < 0.001$; HR max: $r_s = 0.55$, $P = 0.008$). The total eating duration correlated to HR avg ($r_s = -0.62$, $P = 0.002$) but not to HR max ($P > 0.05$). Alertness was shown only by 2 horses in Session 4 (duration 8 and 9 s, respectively and was not analysed).

Discussion

In this study, a negatively reinforced approach to novel objects led to increased sympathetic activity and an increased duration of alertness, compared with horses that were free to explore the objects. This is likely to be related to an experience of lack of control in horses that were led by a human as well as the fact that these horses were required to stand closer to the unknown objects than did horses in the voluntary group. The objects were perceived as mildly frightening as reflected by the relatively short latency to approach the objects as well as the range of maximum heart rate responses (71–138 beats/min). This was considered appropriate in the present set-up due to safety reasons and corresponds to the level of responses in other novel object tests [7–9]. In a recent study with 65 participating horses (3–19 years of age), significantly reduced heart rate responses when the horses were free-running during a fear test, compared with when they were either ridden or led during testing, were reported [9]. This finding corresponds to the result in the present study, indicating decreased stress responses in horses free to express avoidance behaviour during testing.

The horses reacted significantly less already during the second exposure (Session 2), which is in accordance with previous experiments using novel stationary objects [7,8]. Horses in the VOL group chose to feed from the same container (without objects) as they had done in the previous session, although the distance to that container was longer than to the container with objects. Although the VOL horses could see their familiar handler standing next to the objects and were free to explore the objects in the first 3 sessions, they had a significantly longer latency to eat in the post test, compared with the NR horses. Thus, in contrast to our hypothesis, the post test showed that habituation was facilitated by the negative reinforcement procedure. It is noteworthy, however, that although the behavioural responses in the post test suggested that the VOL horses were less habituated to the objects, there was no difference between the treatment groups in their heart rate during the post test. This result indicates that

overall the VOL procedure was probably perceived as less stressful by the horses. Horses in the NR group were prevented from showing avoidance responses and only reinforced for approaching the objects. Furthermore, the horses were encouraged to stand close to the objects through a combination of negative and positive reinforcement. Previous studies have shown that the addition of positive reinforcement increases the motivation of horses to explore and participate in training sessions and reduces stress responses [10,11]. In this study, positive reinforcement was used to maintain motivation and keep the young horses calm during testing in social isolation as well as to be able to determine latencies to start eating. The latency to eat has previously been shown to be a good indicator of stimulus habituation in horses [12].

Heart rate and behavioural reactions correlated well within sessions; increased heart rates corresponded to increased feeding latencies and a decreased eating duration. Object alertness was shown mainly in the first session, whereas object investigation was shown for a significantly longer duration in the post test. For horses in the VOL group this could reflect that they did not come close to the objects in the previous 3 sessions, whereas for NR horses investigative behaviour may have been inhibited in the previous sessions due to the handler, or they may be more motivated to investigate the objects when alone. Object investigation correlated positively to HR responses in the post test, whereas object alertness correlated to HR in the first session. Thus, alertness appears mainly related to initial exposures to novel stimuli, while object investigation may reflect the process whereby the animal becomes increasingly familiar with the objects.

The present study only represents one experimental scenario and aspects such as handler skill and ability to remain calm when leading the horses could be of major importance and may affect the generalisability of the results. Further experiments are needed to investigate whether the same results apply to other situations, including different types and intensity of stimuli, e.g. sudden or auditory stimuli and also for situations where the stimulus approaches the horse rather than vice versa. For instance, horses that are afraid of clippers are often trained via response prevention, but there appears to be a fine limit between response prevention and flooding, which may induce learned helplessness [13]. Furthermore, high levels of fear can have an inhibitory effect on learning and prevention of flight responses should be carefully managed, both due to the safety risk for the handler but also due to the risk of sensitisation, i.e. that the horse comes to show even stronger responses, e.g. through inappropriate reinforcement. For habituation to sudden or moderately frightening stimuli it has been shown that gradually increasing the intensity of the stimulus is beneficial compared with exposing the animal to the full intensity from the beginning [12].

Although habituation is regarded as a simple form of nonassociative learning, it is believed to be a prerequisite for other forms of learning because habituation allows animals to filter out irrelevant stimuli and focus selectively on important stimuli [14]. Habituation is particularly important in horse training due to safety reasons but also because the horse must suppress its innate flight instinct to deal with several aspects of the training environment [15]. For instance, studies have indicated that fearful horses are poorer learners [16,17] and have reduced performance in a novel environment [18], which may be because a high degree of responsiveness to the environment interferes with learning and memory.

In conclusion, a negatively reinforced approach to novel objects leads to a temporary increase in stress responses but the procedure also facilitates object habituation and thus the technique appears to be more efficient compared with a voluntary approach. Prevention of avoidance or fear responses can be dangerous, however, and should be carefully managed. Further experiments should investigate the effect of stimulus type and intensity.

Author's declaration of interests

No competing interests have been declared.

Author contributions

The author was responsible for the study design, data collection and execution, data analysis and interpretation as well as preparation of the manuscript.

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ELSEVIER

ROUNDTABLE/CURRENT TOPICS IN DISCUSSION

Punishment in horse-training and the concept of ethical equitation

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Abstract By definition, punishment makes a response less likely in the future. Because horses are largely trained by negative reinforcement, they are susceptible to inadvertent punishment. Delays in the release of pressure can make desirable responses less likely and thus punish them. This study examines the correct use of negative reinforcement and identifies a continuum between poorly timed negative reinforcement and punishment. It explores some of the problems of non-contingent punishment and the prospect of learned helplessness and experimental neurosis. It concludes by introducing the concept of ethical equitation.

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Introduction

Training relies on timing and consistency and so, by deduction, impaired learning soon arises when there is inconsistency and variable timing. Clear trainers are consistent in their signals and the way in which they set up puzzles for an animal to solve (i.e., the way in which they pose questions). Good technique that reflects these qualities is more sustainable than the size or strength of handlers or indeed any devices that allow handlers to apply more force.

Punishment

Many events are aversive to horses. For example, a sudden noise, the sudden appearance of a stimulus, such as large and/or moving objects, unfamiliar animals even including

their close relative, the donkey. Horse people typically claim that the more unusual looking a species appears to the horse (compared with those to which it has previously become habituated) the more aversive it is. For example, the sight of ostriches and emus is particularly alarming to most horses. Prey animals, such as horses, may even become sensitized to aversive events and this can occur after surprisingly few exposures (McGreevy and Boakes, 2007). Consequently, experiments on fear conditioning can be confounded by habituation. Furthermore, horses can even become aroused and subsequently fearful as a result of rider anticipation. When a rider is told to expect a fear-eliciting stimulus to appear suddenly, his/her horse's heart rate rises (Von Borstel et al., 2007).

Punishment refers to the presentation of a stimulus that suppresses a behavior (McGreevy et al., 2005). It can be divided into 2 categories: positive punishment and negative punishment, depending on whether the punitive situation is either an added or removed stimulus (McGreevy, 2007). Smacking, slapping, whipping, punching, and kicking are typical examples of positive punishment. However,

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the term also embraces even minor amounts of discomfort that suppress any behavior. Negative punishment is the withholding of something attractive, such as food, that is punitive by omission. It is usually not deliberately used in horse training, but does, however, occur inadvertently. Animals being trained in some new behavior will first attempt to offer an established response. The absence of reinforcement at that point makes repetition of this now-unwanted response less likely. Reinforcement has been omitted and therefore the animal has been punished negatively. However, defining punishment purely in terms of its suppressive features is superficial. It is easy to imagine that at one time or another in training, regardless of a trainer's intention to reward or punish, some behavior is being thwarted at any given moment in favor of the one being carried out. Labels such as punishment are therefore limiting.

Punishment terminates the behavior that it follows. However, the behavior that actually follows *after* the punisher is unimportant, whereas in negative reinforcement the behavior that ensues is critical. Thus the theoretic distinction between punishment and negative reinforcement becomes tenuous if the behavior that follows punishment is consistent with a negatively reinforced goal. For example, if the punishing stimulus results in the same behavior each time, one could argue that negative reinforcement is taking place. Take the example of trailer loading. In some countries, horse people have been known to use a long whip or stock whip on the animal's hind-quarters when it refuses to go any farther. However, each time the whip is used the horse runs backward faster, thus having the opposite effect to what was intended. What began as a futile exercise in punishment has now turned into a (more futile) process of negative reinforcement in which the horse, by running backward, has removed itself from the whip. Unfortunately, the amount of violence meted out in the name of punishment is, all too often, totally out of proportion to the original misdemeanor.

Punishment is associated with certain emotional states such as fear and frustration in the punished animal (Lindsay, 2000) and has been shown to decrease learning in horses (Kratzer et al., 1977). Fear and anxiety can be adaptive in that they raise vigilance and promote attempts to regain control of aversive situations. Frustration enhances attempts at restoring instrumental control over available reinforcers. Kandel et al. (2006) pointed out something that Freud also reported: that although certain amounts of fear and frustration may actually enhance learning, high levels tend to depress it, and may contribute to pathologic emotional states. Mills (1998) summarized an array of problems associated with punishment. Specifically, punishment:

1. is nondirective, suppressing but not enhancing alternative behaviors;
2. has the potential to desensitize an animal to the punishing stimulus if the punishment intensity is not optimal;
3. carries the risk of deleterious emotional changes that can interfere with attention and learning; and

4. may be associated by the animal with the person delivering it.

Mills (1998) concluded that punishment presents a range of problems that amount to abuse, and both are best avoided. That said, it should be remembered that horse management relies on punishment frequently. Consider an electric fence, for example. The electric fence is not only a positive punisher but also a highly aversive punisher that may register as such a serious punitive event that an animal will scarcely venture to touch it a second time. As a punishing stimulus, an electric fence at least offers some controllability in the sense that the horse actively chooses to move away and release itself from the aversive stimulus. Compare this with an electric shock collar where the controls are in human hands. The animal has diminished controllability and is at the mercy of the skill and mood of a human. For this reason, many countries have outlawed the use of electric shock collars.

Punishment is used commonly when a horse bites or kicks a human, lunges toward a human or threatens to do so. McLean (2005) has shown that biting and kicking correlate with specific dysfunctions of the go and stop signals in-hand and under-saddle, so it follows that punishing the horse for biting and kicking may be inadvisable. Furthermore, it may not prevent future biting and kicking because it does not remove the cause. This important caution must apply to all situations where punishment occurs. Punishment, therefore, may provide the wrong answer to a problem and as a solution may be too simplistic.

An example is a show-jumping horse that is punished for hitting rails. It cannot be reformed by punishing it on landing. In contrast, the importance of contingency has prompted some jumping trainers to resort to another technique: rapping. Rapping is an illegal practice (outlawed by the Fédération Equestre Internationale rules) that involves an assistant hitting a horse's forelegs as he clears a jumping obstacle. When this is done repeatedly there is a temporary alteration in perception of jumping effort required for a given height.

Negative reinforcement versus positive reinforcement

Many animal trainers focus only on training via positive reinforcement, because their subjects are required to perform at a distance and negative reinforcement (typically by applying pressure) is not possible in these circumstances. Animals such as dolphins, seals, bears, zoo elephants, and dogs, to a large extent, are trained via positive reinforcement. In positive reinforcement, the trainer ignores errors made by the animal. If an animal takes fright, for whatever reason, during training, the trainer waits until the animal chooses to return to the training station. This presents no problem when the subject is at liberty. However, when a

rider is astride the animal, the fleeing-animal situation is critically dangerous. Horse, camel, and working elephant trainers almost universally use negative reinforcement because by this means in adverse circumstances they can virtually 'force' the animal to turn slow or go (Warren-Smith et al., 2007). Herein lies a fundamental difference between positive and negative reinforcement: in the latter the trainer does not have to wait for the animal to offer the response, he can orchestrate it.

Because of the damaging effects of its incorrect use, punishment should be used only when other avenues have been exhausted. In addition it is best used in conjunction with an antecedent secondary punisher (such as the word 'No!') so that the primary punisher itself can be eliminated at some stage. The need for caution with regard to punishment underscores the importance of teaching horse riding coaches the fundamentals of learning theory.

How to use negative reinforcement

Stimulus control can be defined as the degree to which the desired response occurs in the presence of a specific stimulus and does not occur in the absence of this stimulus (McGreevy et al., 2005). In horse training, achieving stimulus control of the basic locomotory responses involves negative reinforcement (Warren-Smith et al., 2005, 2007; Warren-Smith and McGreevy, 2007, 2008), and the following steps have been proposed to achieve this (McLean, 2005):

1. The response to be trained is 'targeted' by the trainer. It is important that only the targeted behavior results in the removal of pressure/discomfort.
2. The pressure (aversive stimulus) should be increased during the 'incorrect' behavior. During this phase, the pressure must not fluctuate or decrease because this constitutes a lowering of pressure and thus could be perceived as reinforcing. The pressure is increased until the targeted response emerges.
3. If intermittent pressures are used (such as nudging by the rider's legs or tapping with a dressage whip) there should be no gaps greater than one second so that the horse does not perceive this transient relief as reinforcing.
4. At the *onset* of the targeted response, the aversive stimulus should be removed immediately. Removal of the aversive stimulus must be absolutely contingent on the onset of the 'correct' behavior.

Non-contingent punishment

In cases where horse behavior is dangerous, such as bucking, rearing, shying, or bolting, trainers often feel justified in delivering punishment. Sometimes this may be effective, although it is difficult to conceive any practical approach for bolting. There are 2 common issues in this use

of punishment. (Both relate to the belief, in some circles, that the horse's behavior was deliberate and that he is aware of his misdemeanors.) The first is the potential for excessive physical punishment (to 'teach him a lesson'), which has no place in a modern training program, and the second is the use of non-contingent punishment. For punishment to be effective it *must* be contingent. Contingency means the punishment must literally be connected to the offending behavior. For example when punishing a horse for kicking, the punishment must occur while the horse is kicking or at the precise moment the kick ends. The use of non-contingent punishment is likely to confuse and frustrate for the animals concerned and will most certainly have deleterious consequences, as it does with dogs (Lindsay, 2000). Because of such problems, punishment is best avoided.

Non-contingent punishment is ineffective

When jumping horses refuse obstacles, it is not uncommon for trainers to use the whip as the horse stands motionless in front of the obstacle after its refusal. Punishment at that point is non-contingent and therefore is devoid of any useful training effect. If it is going to be used, punishment should occur as the horse begins to slow or swerve. In some cases, the refusing horse is punished and then turned away for another presentation. When horses do attempt an obstacle after a random act of punishment, it is possible that increased anxiety levels enhance the flight response and if the horse is successfully steered towards the obstacle it may well jump it. At best, this is a haphazard training exercise destined to have low efficiency, if any. At worst, it simply trains the horse to default to a flight response in the presence of jumps.

Learned helplessness

When animals are exposed repeatedly to pain in the form of sustained, highly aversive stimuli, conditions such as experimental neurosis may escalate so that the animal loses all active control. When the highly aversive stimulus is totally inescapable, learned helplessness may set in. The important distinction here is that the animal no longer tries to cope; it gives up and becomes dull.

Learned helplessness was first identified by Seligman and Maier (1967) and Maier et al. (1969) as a result of their experiments with dogs. These animals showed a deterioration of cognitive, emotional and motivational attributes after repeated exposure to inescapable aversive stimuli. In the experiments, some dogs were trained to switch off an electric shock, administered to their feet, by moving their head sideways, thereby contacting a switch. Other dogs were similarly shocked but were unable to switch off the electricity. The next day, these 2 groups of dogs plus another unexposed group were subjected to electric shocks in a

shuttle box apparatus, where the shocks could be terminated by the dogs jumping a small hurdle. All dogs rapidly learned to jump the hurdles except some of the group that had been unable to avoid the shocks during the experiment the previous day. Those dogs were helpless and instead of trying a response to avoid the shocks, they showed intense hyper-reactivity and then became passive. Weinraub and Schulman (1980) proposed more recently that it was the uncontrollability of the experience rather than the experience of shock itself that interfered with subsequent avoidance learning. It was noted that with sufficient exposures, diminished aggression, and a loss of appetite occurred and the apathy of these dogs persisted long after the experiment. Some trainers may argue that learned helplessness models of horse training (that may include burying horse in grain or even casting) are ethically justified in cases of aggression. The current authors do not concur, because most cases of aggression are based in fear, play, and resource guarding and so can be resolved by removing the motivating causes.

Investigating the effects of previous exposure and controllable shock with rats, Seligman (1975) showed that past experience in dealing with escapable shock *immunized* subjects from the effects of learned helplessness when exposed to inescapable shock later on. On the other hand, naïve rats that had never been exposed to escapable shock became helpless after exposure to inescapable shock. Furthermore, Hannum et al. (1976) showed that rats with previous experience in escaping shock early in their lives performed better in escape learning tasks than did nonshocked controls. In dogs it has been shown that individuals exposed repeatedly to excessive punishment, where they have learned to tolerate pain but not to benefit from it, gradually become unmoved by increasing pain (Lindsay, 2000). Previous exposure to correct pressure-release can partially immunize horses against subsequent bad riding but bad breaking-in can leave a lifetime legacy.

The symptoms of learned helplessness in rats and dogs that have been noted include anhedonia, depression, motivational, emotional, and cognitive deficits (Seligman and Alenor, 1980). Worse still, in the experiments carried out by Weiss et al. (1975) as well as Seligman and Maier (1967), several rats and dogs died as a direct result of the experimental treatments. These events confirm the importance to animals of predictability and controllability, particularly when they are dealing with aversive stimuli. It is not surprising that learned helplessness has been held as an animal model of human reactive depression and post-traumatic stress syndrome (Hall et al., 2007). The neural tissues responsible for generating experimental neurosis and learned helplessness are similar to those that generate depression in humans (Cabib, 2006) and their mechanisms seem to share a profound inhibition of dopamine release in the nucleus accumbens.

Learned helplessness in horses remains unresearched and subject to considerable speculation at this stage.

However, several researchers have identified the possibility (Ödberg, 1987; Lieberman, 1993; Ödberg and Bouissou, 1999). It is likely that some behavioral responses exhibited by the domestic horse are indeed examples of learned helplessness. McLean and McGreevy (2004) pointed out that although many horse people assume the loss of sensitivity in horses with ‘hard mouths’ and ‘dead sides’ is the result of accumulated scar tissue, it is more likely to reflect habituation. Just where this habituation emerges on the continuum that terminates in learned helplessness is not clear. However, the practice of using contradictory acceleration and deceleration signals simultaneously and indeed delivering these signals via amplifiers such as the (lever-action) curb-bit and rowelled spurs make the horse a likely candidate for learned helplessness. Learned helplessness would show up only after the failure of active coping mechanisms such as bucking and hyper-reactivity. Established learned helplessness may compromise horse welfare because an animal in this state has undergone a critical loss of control of its environment (Webster, 1994).

Experimental neurosis

We have seen that gaining control over aversive stimuli is of vital importance to animals. When such control is thwarted, the animal’s well-being is threatened and neurosis may develop. Hence, extra care must be taken when training animals using aversive stimuli because of animals’ imperative to achieve control over such stimuli. Solomon (1964) showed that maladaptive behavior arises when:

1. there are sustained raised levels of arousal;
2. the aversive stimulus is unpredictable;
3. the aversive stimulus is uncontrollable; and
4. the aversive stimulus is inescapable.

Numerous studies attest the problems that emerge when these conditions arise. Pavlov’s (1941) experiments with dogs provided one of the earliest accounts of experimental neurosis, based on discrimination training. In one experiment, he rewarded dogs for associating a leg movement with a circular patch of light, but punished them with an electric shock when they responded to an elliptical one. When the dogs had learned these associations, he began some alterations to the experiment: the elliptical patch was made more circular. At some point the dogs were unable to distinguish between a rewarded shape and a punished one. Some of the dogs became very aggressive whereas others gave up responding and fell asleep. Masserman (1950) carried out a similarly confounding experiment on cats. He trained cats to open a box for a food reward when signaled by a light. Later, when the food box was opened, the cats sometimes received an aversive outcome, such as a blast of air. Again, some of the cats became excitable and hyper-reactive whereas others became dull and refused to move.

Because of their reliance on stimuli that have their basis in aversiveness, horse trainers should be very careful to ensure that the cues and pressures they use result in consistent learned responses and that these operant contingencies do not change throughout the animal's life. The prevalence of hyper-reactivity and dullness among trained horses suggests that at least some training methodologies pay scant regard to the maintenance of consistent operant contingencies throughout the horse's life. For example, in some dressage training systems, self-carriage (that implies the absence of aversive pressure) is seen as a phenomenon that may take years to develop. This suggests that the importance of the reinforcement component of negative reinforcement is either ignored or not understood.

In conclusion, the current knowledge base on the correct use of punishment in equitation is limited. Any attempts to remedy this deficiency should focus on the use of subtle punishers that minimize the need to escalate force. This approach would contribute to the development of ethical equitation.

Ethical equitation

The issue of ethical equitation is fascinating and largely unexplored. The extent to which sport horses are coerced to perform is often the focus of welfare debates. Coercion smacks of slavery and is regarded as distasteful by many animal lovers but, given that negative reinforcement is the critical mechanism, horses cannot be safely ridden without some degree of pressure. Ethical equitation demands that minimal pressure is used for both contact (depending on the sport) and signaling at all times.

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4 Jul 2016

Colic: medical treatment and management in horses

Nicola Menzies-Gow discusses approaches to this abdominal condition in equines, including pain relief, fluid therapy, antiendotoxic therapy and motility stimulants.

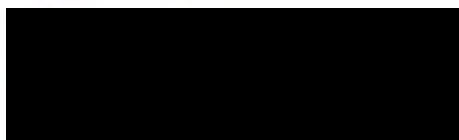
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Figure 1. Horse showing signs of colic.

ABSTRACT

Colic is a common condition in horses and all cases require medical management, to a greater or lesser extent, regardless of the underlying cause and whether they additionally undergo surgery. The aims of medical management are to relieve pain; correct and maintain hydration status, including electrolytes and acid–base disturbances; treat endotoxaemia; and treat ileus. This is achieved using combinations of analgesia, fluid therapy, antiendotoxic therapy and motility stimulants. Drugs used to provide analgesia include NSAIDs, α_2 -agonists, opioids and spasmolytics. Fluid therapy can be administered via the enteral route or intravenously once the deficit has been estimated from the clinical signs and clinical pathology data.

An ongoing fluid therapy plan should then be formulated to account for the maintenance requirements and ongoing losses. In addition, any electrolyte and acid–base disturbances can be corrected using electrolyte supplementation of the fluids and specific fluids. Inotropes and vasopressors should be reserved for specific cases that do not respond to fluid therapy alone. Antiendotoxic therapy options include removing the underlying cause, neutralising circulating endotoxin, inhibiting the endotoxin-induced activation of the inflammatory cascade and inhibiting the endotoxin-induced alterations in the coagulation/fibrinolytic systems. Motility stimulants used in cases with ileus include metoclopramide, lidocaine and erythromycin.

Colic (Figure 1) is a common condition in the horse and all cases require medical management, to a greater or lesser

extent, regardless of the underlying cause and whether they additionally undergo surgery.

The aims of medically managing colic are to:

- relieve pain
- correct and maintain hydration and electrolyte and/or acid-base abnormalities
- treat endotoxaemia
- treat ileus

Analgesia



Figure 1. Horse showing signs of colic.

Before a specific diagnosis has been reached, the ideal drug has a short duration of action, mild to moderate potency, minimal effect on gastrointestinal motility and minimal effect on the cardiovascular system. In contrast, once a specific diagnosis has been reached, a longer duration of action is often more appropriate and products with additional benefits, such as antiendotoxic effects, are often used. However, none of the

following available drugs are ideal and the potential side effects have to be considered in each individual case.

NSAIDs

NSAIDs inhibit cyclo-oxygenase (COX) enzyme and, therefore, the production of prostaglandins and thromboxane. Prostaglandins directly and indirectly stimulate nerve endings – resulting in pain. The side effects associated with NSAID administration in the horse also due to COX inhibition include gastric glandular ulceration, renal papillary necrosis, right dorsal colitis and pancytopenia.

Other potential side effects include delayed recovery of small intestinal epithelial barrier function as prostaglandins stimulate the repair of injured intestine and are critical for the recovery of barrier function.

NSAIDs licensed for treatment of abdominal pain in the horse include:

- metamizole
- flunixin meglumine
- meloxicam
- ketoprofen

α_2 -agonists

α_2 -agonists are hypnotic sedatives with excellent gastrointestinal analgesic properties. These drugs appear to act by stimulation of central α_2 -adrenoreceptors, which modulates the release of norepinephrine and directly inhibits neuronal firing. Side effects include hyperaesthesia, hypotension, bradycardia, gastrointestinal ileus, sweating, diuresis and ecboic effects. Thus, they are effective visceral analgesics, but decrease

gastrointestinal motility for the duration of the period of sedation and are cardiovascular depressants.

α_2 -agonists available for use in the horse include:

- xylazine
- detomidine
- romifidine

Opioids

Opioids act on opioid receptors in the brain, spinal cord, autonomic nervous system, gastrointestinal tract and, peripherally, at terminals of sensory neurones resulting in analgesia. They are classified as pure agonists (such as morphine, pethidine, methadone or fentanyl) or partial agonists (such as butorphanol and buprenorphine).

Side effects include respiratory depression, hypnosis, excitement, mydriasis, locomotor response, bradycardia, pruritus and non-propulsive gastrointestinal spasm. Only butorphanol and pethidine are licensed for the relief of abdominal pain in the horse. Buprenorphine is licensed for the relief of postoperative pain and other drugs are used under the cascade system.

Spasmolytics

Hyoscine butylbromide (N-butylscopolamine) is a spasmolytic agent with particular activity on the smooth muscle of the digestive and urinary systems. It antagonises the actions of acetylcholine at the muscarinic receptor and also has some activity at nicotinic receptors. It is licensed in the UK as an aid in the control of pain associated with simple equine colic, as a diagnostic aid in more severe equine colics and for the control of

diarrhoea in horses, particularly when pain or abdominal discomfort is present.

Infusions

Analgesia can also be provided in the form of a constant rate infusion – for example:

- Butorphanol – 12mg/kg/hr.
- Morphine – 0.3mg/kg loading dose, then 0.05mg/kg/hr.
- Lidocaine – 1.3mg/kg over 15 min, then 0.05mg/kg/min.
- Ketamine – 0.4mg/kg/hr to 0.8mg/kg/hr.
- Trifusion – loading doses of lidocaine (1.3mg/kg over 5 min) and morphine (0.1mg/kg IV bolus) followed by infusion of bag one containing lidocaine (3mg/kg/hr) and ketamine (0.6mg/kg/hr) and bag 2 containing morphine (0.025mg/kg/hr).
- Pentafusion – loading doses of lidocaine (1.3mg/kg over 5 min) and morphine (0.1mg/kg IV bolus) followed by infusion of bag 1 containing lidocaine (3mg/kg/hr) and ketamine (0.6mg/kg/hr) and bag 2 containing morphine (0.025mg/kg/hr), detomidine (0.0044mg/kg/hr) and acepromazine (0.0022mg/kg/hr).

No veterinary-licensed opioids are approved for administration by infusion.

Fluid therapy

Aims

The aims of fluid therapy are to restore the circulating volume and improve the cardiac output – which, in turn, will increase

oxygen delivery to the tissue and sustain aerobic metabolism – and correct electrolyte and/or acid–base disturbances.

Estimating deficit

Estimation of the fluid deficit in an individual animal is based on the clinical signs and clinical pathology data. The clinical parameters that should be assessed include the heart rate, jugular refill time, mucous membrane colour, capillary refill time, skin turgor, temperature of the extremities and urine output.

The clinical pathology parameters that should ideally be measured include the blood PCV, total protein, creatinine, urea and venous oxygen concentrations, urine–specific gravity and the central venous pressure. However, it should be remembered these should be interpreted in light of the primary condition. For example, pain will also cause the heart rate to increase, while a protein–losing enteropathy may mask any dehydration–associated increase in total protein. A horse will start to show mild signs at 5% dehydration and severe signs at 12% dehydration.

Enteral fluids

Enteral fluids are contraindicated if there is ileus, intestinal obstruction, severe mucosal inflammation, the horse is unable to stand, or if the horse requires rapid, large volume resuscitation. The advantages of enteral fluids are lower cost and the fact the gastrointestinal mucosa acts as a natural selective barrier – making iatrogenic imbalances less likely, absorption is increased in hypovolaemia and the haemodynamic effect is rapid (evident from 30 minutes).

Thus, enteral fluids are indicated to restore the hydration status and electrolyte balance, or to prevent this from occurring in horses with ongoing losses that are not drinking. In addition, they

are indicated to increase the hydration of the gastrointestinal contents and to stimulate intestinal motility via the gastrocolic reflex.

Enteral fluids are administered via a nasogastric or naso-oesophageal tube as a bolus or continuously. Ideally, the fluid administered should be made isotonic through the addition of sodium chloride (4.9g/L of water) and potassium chloride (4.9g/L water).

Potential complications include aspiration, abdominal discomfort, gastric rupture and nasogastric tube-associated complications.

Intravenous fluids

Vascular access



Figure 2. The jugular vein is the only site suitable for high volume resuscitation.

The jugular vein is most commonly used as the site for catheter placement (**Figure 2**) as it is the only site suitable for high volume resuscitation – and it should be remembered both jugular veins can be catheterised if maximum volume resuscitation (about

35L/hr) is required. Alternative sites for catheter placement include the lateral thoracic, cephalic and saphenous veins.

Fluid therapy plan

A fluid therapy plan should be formulated to take into account the current deficit, maintenance requirements (40ml/kg/day to 60ml/kg/day) and ongoing losses – for example, diarrhoea and gastric reflux. The appropriate type of replacement fluid should be selected and the deficit should be replaced over the next few hours (**Figure 3**). Commonly, about half of the deficit is administered and then the horse reassessed to determine the response to therapy by serially measuring various clinical signs and laboratory parameters, with the remaining requirement adjusted as necessary.

Solutions

Available solutions are either crystalloids or colloids. Crystalloids contain water, sodium or glucose, other electrolytes, plus or minus a buffer. The fluid may be hypotonic, isotonic or hypertonic relative to plasma. They distribute between the intravascular (25%) and interstitial compartments (75%) within one hour, thus, 1L of crystalloids results in a 250ml increase in plasma volume.

Distribution into the interstitial compartment is beneficial if the animal is dehydrated as well as hypovolaemic, but it will also promote tissue oedema formation, which may compromise perfusion.

Distribution into the intravascular compartment will result in a decrease in the total protein concentration (through dilution), which, in turn, will decrease the colloid osmotic pressure, thus favouring further fluid loss into the interstitium, which, again, may be beneficial or detrimental depending on the individual case.

These factors should all be borne in mind when considering the fluid therapy plan.

Isotonic polyionic solutions are the most commonly used crystalloid solution in equine veterinary practice. Their electrolyte composition is similar to plasma; however, the potassium concentration is too low for maintenance requirements, so 10 milliequivalent potassium chloride; mEqKCl/L to 20mEqKCl/L should be added. Hartmann's solution is most commonly used as it is available in 5L bags. Isotonic saline (0.9% sodium chloride; NaCl) is hypernatraemic and hyperchloraemic relative to plasma and lacks other electrolytes. It is only available in 1L bags and so is primarily used in cases of hyponatraemia and hypochloraemia, rather than for resuscitation or maintenance.

Hypertonic saline (7% NaCl to 7.5% NaCl) is hypertonic relative to plasma, so it initiates movement of water into the intravascular space from the interstitium, resulting in rapid expansion of the circulating volume. The plasma volume expansion achieved is two times to four times that of the infused volume (2ml/kg to 4ml/kg). However, this will result in intracellular dehydration, so it should be followed up with 10L isotonic fluids for every 1L of hypertonic saline administered within 2.5 hours.



Figure 3. Intravenous fluid therapy.

A 5% dextrose is a hypotonic solution, which will replace water without electrolytes, thus, it is only used in animals that are hypernatraemic and hyperchloraemic. It should be used with caution as it can cause hyperglycaemia with rapid administration, which will subsequently result in osmotic diuresis and so further fluid loss.

Colloids contain large sugar or protein molecules and are a mix of large and small molecules. The advantages of colloids over crystalloids are the large molecules improve oncotic pressure and they provide rapid intravascular volume replacement by expanding the plasma volume by 100% to 200% of the volume infused, thus improving microvascular perfusion with less tissue oedema formation. The disadvantages are they are affected by alterations in capillary permeability, do not correct dehydration (interstitial losses) and can have side effects in some animals. Colloids available in the UK include plasma, whole blood and the synthetic colloid gelofusine.

Electrolyte supplementation

Electrolyte concentrations should be measured as the initial correction of the fluid deficit and then appropriate supplementation of the fluids should be initiated and the response monitored.

Acid-base disturbance

The most common acid-base disturbance encountered is metabolic acidosis, which occurs as a consequence of lactic acidosis secondary to hypovolaemia and/or endotoxaemia, or of hyponatraemia secondary to colitis, peritonitis or gastrointestinal torsion.

Metabolic alkalosis occurs as a consequence of hypochloraemia secondary to high volume gastric reflux or of hypoalbuminaemia. Respiratory acidosis may occur as a consequence of hypoventilation and respiratory alkalosis may occur as a consequence of hyperventilation due to pain. Treatment should be aimed at the underlying cause, thus, lactic acidosis should be treated with a large volume of polyionic fluids, hyponatraemia

with normal or hypertonic saline, hypochloraemia with normal saline and hypoalbuminaemia with colloids.

Vasopressors and inotropes

Critically ill horses often have disturbances of their cardiovascular system, which can result in inadequate oxygen delivery. For example, endotoxaemia and ischaemia-reperfusion injury may induce capillary damage, allowing fluid and albumin to leak out, causing hypovolaemia and reduced intravascular colloid oncotic pressure and increased interstitial colloid oncotic pressure to draw out more fluid. Sepsis and endotoxaemia are also characterised by vasodilation, which leads to relative hypovolaemia, and endotoxin and sepsis result in cytokine production that cause myocardial depression.

Inotropes and vasopressors can be used to ensure adequate oxygen delivery to the tissues if it is still insufficient following appropriate fluid therapy. Inotropes increase the cardiac output by increasing the stroke volume and evidence suggests dobutamine is the best available drug. Vasopressors increase the blood pressure through arteriolar vasoconstriction, which increases the pressure gradient across a capillary bed, allowing better perfusion. However, it will also increase the resistance to flow, so the dose needs to be titrated carefully to achieve optimum balance between perfusion pressure and flow. Evidence suggests noradrenaline is the first choice drug.

Antientotoxic therapy

The aims of antiendotoxic therapy are to:

- Remove the underlying cause. This involves surgical correction of intestinal lesions, drainage of peritoneal

effusions and antibiotic therapy.

- Neutralise circulating endotoxin. Polymyxin B binds to the lipid A and neutralises endotoxin. Low doses (6,000IU/kg IV q8–12h) can be used systemically without toxicity.
- Inhibit the endotoxin-induced activation of the inflammatory cascade. Options for inhibition of endotoxin-induced inflammation include the NSAID flunixin meglumine, pentoxifylline and lidocaine.
- Modulate the endotoxin-induced alterations in the coagulation system.

Endotoxin-induced inflammatory mediators activate the coagulation system and inhibit the fibrinolytic system. This procoagulant state exhausts the supplies of clotting factors so bleeding diathesis then ensues. Options for therapy include plasma transfusion to replace the supply of clotting factors and low molecular weight heparin to bind to antithrombin III – increasing its affinity for and inhibition of activated clotting factor X.

- Provide circulatory support.

Fluid therapy is an essential part of the treatment of endotoxaemia.

Motility stimulants

Postoperative ileus should be treated with a combination of analgesia, decompression, antiendotoxic therapy, correction of electrolyte imbalances and the following available prokinetic drugs.

Lidocaine

Lidocaine improves gastrointestinal smooth muscle contractility, but the mechanism involved is unknown and also has analgesic and anti-inflammatory properties. It is administered as a loading dose of 1.3mg/kg IV bolus over 5 minutes, followed by 0.05mg/kg/min IV infusion for 24 hours. Side effects include muscle fasciculations, ataxia and seizures.

Metoclopramide

Metoclopramide augments acetylcholine release from cholinergic neurones stimulating motility in the stomach and proximal duodenum. It should be administered as 0.25mg/kg IV in 1L of saline over 30 minutes to 60 minutes or as 0.08mg/kg/hr to 0.14mg/kg/hr infusion. Potential side effects include CNS excitement due to dopaminergic antagonism.

Erythromycin

Erythromycin acts via motilin and/or five hydroxytryptamine receptors. However, the prokinetic response may decrease with repeated use due to receptor down-regulation. It should be administered as 2mg/kg IV qid by slow IV injection. Undesirable side effects include abdominal pain.

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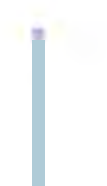
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Forage, freedom of movement, and social interactions remain essential fundamentals for the welfare of high-level sport horses

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Societal concerns for animal welfare extend to all domestic species, including high-level sport horses. The welfare of these horses, notably highlighted during the recent Olympics, has garnered significant public interest, prompting inquiries into their living conditions. Animal welfare studies have emphasised three key needs crucial to equine welfare: unlimited access to forage, freedom of movement, and social interactions with peers, commonly referred to as the “3Fs”—access to Forage, Freedom of movement, and interactions with Friend conspecifics. However, the feasibility and benefits of satisfying these needs specifically for sport horses remain unexplored. Indeed, they may face unique challenges such as high physical workload, extensive travel, limited time in their home stables, weight management, and high economic value necessitating careful handling. Consequently, restrictions on feeding, freedom of movement, and social contact are often deemed necessary. This field study aims to assess the actual level of implementation of welfare in high-level sport horses by evaluating body condition, injury risk, and behavioural welfare indicators in their home stable. To achieve this objective, the welfare of 56 high-level sport horses competing internationally was assessed using behavioural indicators of welfare through scan sampling (abnormal behaviours, i.e., stereotypies, aggression towards humans, withdrawn behaviour, and alert behaviours; positions of the ears in a backward position while foraging, watching behaviours, and through other Animal Welfare Indicators (AWIN) protocol measures). This study shows that there exists a large variability among horses regarding their access to the 3Fs, with some of them having a lot of restrictions and others not, meaning it is possible to respect them while competing at a high level. Second, we observed that the fewer restrictions the horses experience regarding the 3Fs while in their home stables, the better their welfare, as demonstrated by the indicators we assessed. These results undeniably support the fact that unrestricted access to forage, the ability to move freely outdoors, and the opportunity to interact socially with conspecifics are fundamental needs of horses that could be provided to horses, also to high-performance ones. It is therefore essential that solutions are put in place to ensure that these conditions are met.

KEYWORDS

equestrian, horse management, athlete horses, horse living conditions, wellbeing indicators, stereotypies, equestrian competitions

1 Introduction

The welfare of high-level sport horses used in equestrian sports, and in particular the Olympic Games, is a growing societal issue that the International Equestrian Federation has recognised and responded to by setting up the Equine Ethics and Welfare Commission.¹ There are many studies on the factors that promote the welfare of horses (1), including high-performance horses (2–4). However, high-level sport horses usually have very specific living and working conditions (2). They can undergo intensive daily training, travel extensively worldwide for competitions, spend limited time in their home stables, require careful weight management, and have high sentimental and economic value necessitating close monitoring, particularly to prevent injuries. Consequently, for their owners, restrictions on feeding, freedom of movement, and social interactions with conspecifics are often deemed necessary for the management of these conflicts, which arise between the demands of competition and the horse's basic needs (5–8).

Restrictions of these natural needs negatively impact the welfare of horses (1). The three criteria related to these needs are called in the equine sector as the “3Fs”, a term first introduced by the equine behaviourist L. Fraser (Forage, Freedom, and Friends) and defined as groups of needs of horses that should be satisfied by horses.² Unlimited forage is essential for the horse's physiological needs as it can eat up to 16 h a day, providing fibres throughout the day (9). It has been observed that forage deprivation can rapidly cause health problems such as gastric ulcers (10) and metabolic changes (11). Food restriction can also lead to the development of abnormal behaviours, as suggested by studies showing a link between a higher prevalence of stereotypies and a limited quantity of hay in horses (4, 12). Freedom of movement, or the ability to move freely outside of working or training hours, is an essential criterion for a horse's welfare. If this need is not met, it can affect their mental and physiological health (1, 4, 13–15). It has been shown that freedom of movement, whether in the paddock or pasture, reduces stereotypy (4, 16) and aggression towards humans (16). In addition, certain stress markers such as glucocorticoids decrease following locomotor activity (17), and oxytocin levels have been shown to increase during a daily paddock release period (4). Finally, as horses are social beings living in groups under natural conditions, long-term bonds are essential to them (18). Deprivation of social contact from a very young age affects horse welfare. The study by Heleski et al. (19) showed that young horses living individually in stalls exhibited more abnormal behaviours such as licking or chewing the stall than those living in groups. Another study showed that 67% of the young horses in the study developed at least one stereotypy when housed individually for the first time (20). Furthermore, being in an individual stall also has long-term effects, and the longer a horse is in an individual stall, the more likely it is to develop unresponsiveness to its environment (13). Finally, the restriction of social contact with other conspecifics also has a physiological impact, with individually housed horses showing impaired glucocorticoid levels as a marker of stress (21).

Despite the extensive literature on the impact of these 3Fs on welfare, studies are often limited to similar types of horses from equestrian centres, and sometimes racehorses (12, 22), with high-level sport horses rarely included (2–4). However, high-level sport horses have unique characteristics as described above. It is therefore necessary to study in more detail the possibility of assurance of 3Fs in these specific horses.

In horses, welfare can be evaluated through various indicators or protocols (23–29). One set of indicators concerns the prevalence of abnormal behaviours, such as stereotypies, that can be defined as a repetitive behaviour caused by frustration and repeated attempts at coping and may also be the result of a central nervous system dysfunction (30). Moreover, three behaviours have been identified as representative of poor welfare in horses: alert behaviours, withdrawn behaviours, and aggressiveness towards humans (31). The position of the ears while the horse eats is also an indicator of the horse's welfare quality. In fact, it has been shown that horses feeding with their ears turned backward are also those showing a pessimist judgement bias (32) and is described as a reliable indicator of altered horse welfare (25).

Another indicator of a horse's welfare is the behaviour of standing and scanning the environment. This behaviour is part of the horse's normal behavioural repertoire as they typically spend between 6 and 10% of their time budget engaging in it (18). However, several studies show that when its prevalence is high, it could be a sign of altered welfare. Indeed, isolated mares exhibited more of this behaviour than mares confined to stalls or in pasture (33). Furthermore, it has been observed that the frequency of observation behaviour in horses is linked to chronic back pain (34). This makes this behaviour an interesting indicator of the horse's welfare as it is a behaviour that can be easily observed and quantified. In addition to the behavioural indicators of welfare, we incorporated physical measures from the Animal Welfare Indicators protocol for horses (35), as the body condition score and alopecia.

The objectives of the present study were (1) to determine whether the 3Fs (Forage, Freedom, and Friends) are assured in high-level sport horses despite their specific use and (2) to investigate the relationships between categorical variables representative of each “F” and the expression of behavioural and physical indicators of poor welfare. Based on previous studies (1, 15, 22), we hypothesised that a proportion of elite sport horses would meet the 3Fs and that the 3Fs would remain essential for their welfare, notwithstanding their particular living conditions. We predicted that increased access to forage, freedom of movement, and social interactions with conspecifics in their usual stable environment would correlate positively with improved welfare indicators as lower prevalence of abnormal behaviours, reduced instances of backward ear positioning while foraging, and decreased vigilance behaviour. The study also examined the effects of unrestricted forage access on body condition scores and evaluated how increased freedom of movement and social contact influenced injury rates and skin alterations. This approach challenged the common practice of limiting these factors in high-performance horses, typically implemented to prevent injuries and manage weight (2, 7).

2 Materials and methods

2.1 Ethics statement

The authors compiled with the ARRIVE guidelines. The present study was approved by the Val de Loire Ethical Committee (CEEA

¹ <https://equinewellbeing.fei.org/>

² https://inside.fei.org/system/files/EEWBC%20Final%20Report%20to%20FEI%20Board_Updated%2014Nov23.pdf

VdL) and attributed a positive recommendation (authorisation number: CE19 – 2023-3110 – 2).

2.2 Animals studied

Fifty-six high-level sport horses from 13 French private stables were studied (12 mares, 30 geldings, and 14 stallions; mean age $\pm$ SD: 10.61 ± 2.69 years). During each visit to the 13 stables, a sample of between two and eight horses was studied over the course of the day. They were competing in show jumping and eventing at international levels, and 11 of them were considered for the French team for the 2024 Olympic Games. The horses were observed in their usual environment (their home stables) between March and September 2023, with the consent of their riders/owners and the French Equestrian Federation. The horses lived in boxes ranging from 13 square metres to 35 square metres (mean $\pm$ SD: 24.5 ± 5.7), and their bed material consisted of straw or shavings. Horses were all trained between 5 and 7 days a week, with each session lasting between 30 and 60 min, took part regularly in international competitions (some participating in more than 50 competitions a year), and had regular veterinary and osteopathic monitoring. Their living conditions are detailed below.

2.3 Forage access assessment

We evaluated whether the hay was distributed “*ad libitum*” or “rationed”. The criteria for unlimited access to hay were either a hay net system or portions large enough to leave sufficient hay when the next portion arrived. Based on this information, horses were grouped into two categories of the variable “access to forage” (F-forage): those with unlimited access to forage during the day and those with rationed forage.

2.4 Freedom of movement assessment

Freedom of movement assessment was determined according to the type of accommodation for each horse. The main type of housing (i.e., the housing where the horse spends the most hours during the day) for each horse was evaluated and included three possible levels of the variable “access to free movement” (F-movement): (1) over a 24 h day, the horse lives more outdoors than in the box: in this case, the horse was placed into the category “living more in pasture or paddock than box”; (2) over a 24 h day, the horse lives more in the box than into the paddock or pasture: in that case, the horse was placed in the category “mainly in box”; and (3) the horse lives in the box almost exclusively (goes outside in pasture or paddock for 1 h or less in a week): in this final case, the horse was placed in the category “box exclusively.”

2.5 Social interaction levels’ assessment

Social interaction assessment was determined according to the levels of possible contact with any other horses through their type of housing and evaluated for each horse by the observer during the visit

of the stables. Three levels described in the Animal Welfare Assessment Protocol for horses (35) were used to categorise the level of possible social interaction for each horse. If the horse had at least the possibility to nibble and partly groom another horse, it was placed in the first category of the variable “access to social interaction” (F-social) variable labelled “tactile interaction”. This category included horses that could nibble each other through their box or paddock and those that could fully interact with other horses when placed together in a pasture or paddock. The second category included horses that could only sniff each other through the grids of their box or paddock and was labelled “possibility to sniff”. Finally, if the horse could only have visual contact with other horses, it was placed in the category labelled “visual interaction”. In this third category, horses can only see other horses from their box door or window, or from the paddock, but cannot sniff other horses muzzle to muzzle.

2.6 Abnormal behaviour ratio, backward ears ratio while foraging, and watching behaviour ratio

The evaluation of these behaviours was done using the scan sampling method over the course of a whole day by a single person (a PhD student of ethology) who had been previously trained in this method. This method previously described (36) consists of repeatedly observing the horse’s behaviour at regular intervals (here every 2 min). The observer walked discretely 2 m from the stall or paddock and noted the horse’s behaviour at a given moment. The observer should be silent to avoid being spotted by the horse being observed, to avoid any change in behaviour at the time of the observation. In the present study, 56 horses were observed over the course of a day from 9.20 a.m. and 5 p.m. The observer conducted a round every 2 min, moving from one horse to the next and noting the behaviour of each horse under observation (31). However, during the scan sampling observation periods, 16 horses were moved from the study for the purposes of undergoing training, undergoing veterinary check-ups, or otherwise, while they were observed. Consequently, they have been excluded from the subsequent analyses. As a result, 40 horses were observed for a total of 3,412 observations (85.3 ± 25.16).

The abnormal behaviour ratio was calculated from the observations of the scan sampling method. Based on the incidence of any of abnormal behaviours, the ratio included the following behaviours: stereotypies, aggressiveness towards humans, withdrawn, and hypervigilance behaviour. The ratio also included other abnormal behaviours such as gnawing on the bars of the box, gnawing on the feeder, door kicking, weaving, headshaking, crib-biting, licking on non-food, and tongue rolling. All abnormal behaviours are defined in the [Supplementary Table S1](#). The abnormal behaviour ratio for each horse was calculated as follows: number of observations where the horse was displaying an abnormal behaviour divided by the total number of observations of the horse.

A previous study has shown that a chronic negative emotional state could be revealed by backward ears position in eating behaviours (32) and is a reliable indicator of compromised equine welfare (25). Therefore, backward ears while foraging has been used in the present study. Backward ears ratio while foraging was calculated from the observations of the scan sampling method and took into account all observations where the horse was foraging with its ears turned

backward (apart during concentrate food distribution times and consumption). Positions of the ears are defined in [Table 1](#). These observations were then divided by the total number of observations where the horse was foraging to obtain the backward ears ratio while foraging for each horse.

Watching behaviour ratio also comes from observations of the scan sampling method. In the present study, we took into account all the behaviours in which the horse watched its environment ([Table 1](#)). The ratio was calculated by dividing the number of observations where the horse watched its environment by the total number of observations of the horse.

2.7 Physical measures

2.7.1 Assessment of the body condition score

The body condition score was assessed by a single observer who had been previously trained in accordance with the guidelines of the French Horse protocol which is derived from the Animal Welfare Assessment Protocol for horses (35). The body condition score assessment was shown to be reliable, with assessors consistently scoring body condition after proper training (29). This assessment takes into account the evaluation of six body zones to obtain a final score for each horse.

The observer began with a general visual inspection of the horse. Then, six areas were specifically targeted: ribs, back of shoulder, withers, neck, tail attachment, and croup. For each area, a score from 1 (very thin/skeletal) to 5 (obese/overweight) was given according to the AWIN scoring scale. The score took into account the level of fat/muscle covering each area. The body condition score was then calculated from the scores for the six zones, with the different zones weighted as follows.

$$\begin{aligned} \text{Body condition score} = & (\text{ribs' score} \times 0.6) \\ & + (\text{back of the shoulder's score} \times 0.15) \\ & + (\text{withers' score} \times 0.10) + (\text{neck's score} \times 0.15) \\ & + (\text{tail attachment's score} \times 0.05) + (\text{croup's score} \times 0.005) \end{aligned}$$

2.7.2 Assessment of the alopecia score

The alopecia score was evaluated by a single observer who had been trained in the Animal Welfare Assessment Protocol for horses beforehand (35). The alopecia took into account the total number of alopecia which could be defined as hairless spot or scar (35). There was no minimum size required to be taken into account, the observer looked at the whole body of the horse and noted all the alopecia and their localisation. Alopecia located on the horse's equipment areas (e.g., noseband, headpiece, and girth passage) were not counted as they were not the result of access to forage, freedom of movement, and social interactions with other conspecifics.

2.8 Other measures included in the animal welfare assessment protocol for horses

We also recorded additional measures ([Supplementary Table S2](#)), from the Animal Welfare Assessment Protocol for horses (35) beyond those previously described. These measures were collected by the same observer on the same days as the previous observations. Thus, the following environmental measures were assessed: water availability, water cleanliness, sufficient quantity and cleanliness of bedding

TABLE 1 Description of behaviours observed on horse.

Abnormal behaviour	Description
Stereotypies	Repeated behaviour which has no specific function or goal and does not vary (47). All stereotypies are described in the Supplementary Table S1 .
Aggressiveness towards human	Threats or physical attacks directed towards a human (ears pinned backward sometimes with the mouth open) (31).
Withdrawn behaviour	Standing with eyes open, fixed gaze, few or no blinks, eyelids do not droop, and the horse do not respond to external sensory stimulus of its environment (31).
Alert behaviour	Remaining vigilant in position, with awareness and a raised neck, carefully surveying the environment, occasionally shifting either head or ears (48).
Other abnormal behaviours	Behaviours described in the Supplementary Table S1 as stereotypies but expressed once as gnawing on the box's bar, gnawing on the feeder, weaving, headshaking, crib-biting, licking on non-food, and tongue rolling.

Ears position in eating behaviour	Description
Forward	The pinnae of both ears are directed forward.
On the side	The pinnae of both ears are directed on the side.
Backward	The pinnae of both ears are directed backward.
Asymmetric	The pinna of one ear is directed forward or to the side, while the other is directed backward.

Watching behaviour	Description
Watching behaviour	Standing still with the neck held horizontally or slightly raised, while the ears and neck remain mobile. The horse slowly surveys its surroundings by moving its head side to side or briefly looking at environmental stimuli occasionally (34).

material, and adequate box dimensions. Furthermore, animal-based measures were evaluated, including integument alterations, absence of swollen joints, lameness and prolapse, hair coat condition, discharges, consistency of manure, breathing and absence of coughing, absence of horse grimace scale, state of the hoofs and lesions at the mouth corners, and a series of human–animal relationship tests.

2.9 Statistical analysis

All statistical analyses were performed using R software (R version 4.2.3) with a significance level set at a p -value of >0.05 .

We used Fisher's tests (*fisher.test* function) to check for potential collinearity between our variables of interest (access to forage: "F-forage," access to freedom of movement: "F-movement," access to social interaction: "F-social"). Significant associations were found between F-forage and F-movement (p -value <0.001), between F-movement and F-social (p -value <0.001), and between F-forage and F-social (p -value <0.001). A contingency table showing the number of horses for each variable was created to give an overview of the distribution of each group (Table 2). The purpose was to analyse the relationship between the F-variables and the abnormal behaviour ratio, the backward ears ratio while foraging, the alopecia score, and the watching behaviour ratio (Table 3). Given the collinearity between the F-variables, an initial stage of the analysis involved the joint

examination of the F-variables using a multiple correspondence analysis (MCA). The MCA was used on the modalities of the F-variables, using the *MCA* function from the FactoMineR package (37). We then performed Spearman's correlations (*cor.test* function) between the coordinates of individuals on dimension 1 and dimension 2 of the MCA and the behavioural (abnormal behaviour ratio, backward ears ratio while foraging, and watching behaviour ratio) and physical (alopecia score) measures.

Then, a more detailed analysis investigates each of the F-variables individually, while keeping in mind that these three variables are closely related. To compare the behavioural and physical measures as the abnormal behaviours, the backward ears ratio while foraging, the watching behaviour ratio, and the alopecia score between horses with limited access to forage and horses with unlimited access to forage, Mann–Whitney tests (*wilcox.test* function) have been used.

To compare whether the level of F-movement and F-social affected the behavioural measures (abnormal behaviour ratio, backward ears ratio while foraging, and watching behaviour ratio) and the physical measure (alopecia score), Kruskal–Wallis rank-sum tests (*kruskal.test* function) were used. Then, to find out between which modalities the significant differences were, *post-hoc* Dunn's tests (*dunn.test* function) were performed with a Bonferroni correction.

The additional measures from the Animal Welfare Assessment Protocol for horses (35) are presented as descriptive analyses. Due to

TABLE 2 Contingency table presenting the relation between the access to forage (F-forage), freedom of movement (F-movement), and social interaction (F-social) of the horses.

F-movement				
		Box exclusively	Mainly in box	Pasture or paddock > box
F-forage	Limited	20	8	4
	Unlimited	2	14	8

F-social				
		Visual interaction	Possibility to sniff	Tactile interaction
F-forage	Limited	9	23	0
	Unlimited	6	10	8

F-movement				
		Box exclusively	Mainly in box	Pasture or paddock > box
F-social	Visual interaction	6	9	0
	Possibility to sniff	16	13	4
	Tactile interaction	0	0	8

TABLE 3 Results of Spearman's correlation between the coordinates of Dim1 and Dim2 of the MCA and behavioural and physical variables.

Variables		DIM1		DIM2	
		Rho value	p -value	Rho value	p -value
Behavioural measure	Abnormal behaviour ratio	−0.56	<0.001	0.07	0.65
Behavioural measure	Backward ears ratio while foraging	−0.46	0.0044	0.52	<0.001
Behavioural measure	Watching behaviour ratio	−0.27	0.085	0.42	0.006
Physical measure	Alopecia score	−0.48	<0.001	0.34	0.02

Bold values indicate those with a p -value < 0.5 .

a lack of variability in the measures, no additional statistical analyses were performed on these data.

2.10 Data availability

Data generated and analysed during the study are available in the INRAE data repository from the following link: <https://doi.org/10.57745/HLNFN3>. Please contact R.P. for any request on the data availability.

3 Results

3.1 Descriptive analysis

In terms of access to forage, 57.1% of the horses studied were observed to have limited access, while 42.9% were observed to have unlimited access. Regarding the level of freedom of movement, 39.3% of the horses were living in box exclusively, 39.3% were living mainly in box, and 21.4% were living more in pasture or paddock than in the box. Concerning social interaction, 26.7% of horses had visual interaction with other horses, 58.9% had the possibility of sniffing other horses, and 14.2% could experience tactile interaction with other horses (Supplementary Table S2).

Out of 40 horses observed using the scan sampling method and regarding the abnormal behaviours, 20% performed at least one stereotypy, 20% showed aggressiveness towards humans, 2.5% alert posture, and no withdrawn posture was observed.

With regard to the environmental measures of the Animal Welfare Assessment Protocol for horses (35), it was observed that 100% of horses had access to clean water, 88.8% of horses had a sufficient quantity of bedding material, 100% had clean bedding material and adequate stall dimensions. For the animal-based variables, 100% of them did not show swollen joints, signs of hoof neglect, deep wound, lesions at mouth corners, prolapse, and ocular, vulva, or penis discharge. In addition, 100% showed a healthy hair coat condition, normal breathing, and an absence of pain grimace, and 97.9% had an optimal body condition score. Only 1.8% had a cough, 10% had a slight nasal discharge, and 5.5% of the manure had an abnormal consistency. At least one alopecia was found in 97.7% of the horses (median = 5.5 [IQ1: 4, IQ3: 13.25], min = 1, max = 30), 29.1% had at least one skin lesion (median = 0 [IQ1: 0, IQ3: 1], min = 1, max = 3), and 25% had at least a swelling (median = 0 [IQ1: 0, IQ3: 0.25], min = 1, max = 4). Finally, with regard to the human–animal relationship tests, 94.4% of horses show no negative signs for the avoidance distance test, as well as 89.3% for the voluntary animal approach test and 88.8% for the forced human approach test. All the data of the protocol are summarised in the Supplementary Table S2.

3.2 Relationships between the F-variables and the indicators of welfare

Regarding the MCA results, the first dimension (Dim1) explained 41.7% of the overall variance, and the second dimension (Dim2) explained 27.7% of the overall variance (Figure 1). For Dim1, the F-forage was correlated at 0.52, the variable F-movement was

correlated at 0.76, and the variable F-social was correlated at 0.80. Thus, the Dim1 was labelled “Respect for the F-variables.” For Dim2, the variable F-forage was correlated at 0.22, the variable F-movement was correlated at 0.80, and the variable F-social was correlated at 0.35. Thus, the Dim2 represents the weight of F-movement.

The coordinates on Dim1 were significantly and negatively correlated with the abnormal behaviour ratio, the backward ears ratio while foraging, and the alopecia score. It tends to be correlated with the watching behaviour ratio (Table 3). The coordinates on Dim2 were significantly and positively correlated with the backward ears ratio while foraging, watching behaviour ratio, and the alopecia score but not with the abnormal behaviour ratio (Table 3).

3.3 Effect of “forage access” categorisation (F-forage)

Percentages of abnormal behaviour were significantly higher for horses with limited access to forage compared to horses with unlimited access to forage (Figure 2, Mann–Whitney test, $W = 121.5$, $p\text{-value} = 0.021$).

Percentages of ears backward while foraging were significantly higher for horses with limited access to forage (Mann–Whitney test, $W = 246.5$, $p\text{-value} < 0.001$) compared to horses with unlimited access to forage (Table 4). Percentages of watching behaviour were higher for horses with limited access to forage (Mann–Whitney test, $W = 275.5$, $p\text{-value} = 0.04$) compared to those with unlimited access (Table 4). The alopecia score did not differ depending on the type of access to the forage (Mann–Whitney test, $W = 300.5$, $p\text{-value} = 0.11$, Table 4).

3.4 Effect of “access to freedom of movement” categorisation (F-movement)

Percentages of abnormal behaviour differed depending on the access level of the F-movement variable (Kruskal–Wallis rank-sum test, $p\text{-value} < 0.001$). Horses housed in boxes exclusively showed a higher percentage of abnormal behaviour compared to horses living more in pasture or paddock than in box (Figure 2, Dunn’s test, $p\text{-value} < 0.001$) and horses living mainly in box (Figure 2, Dunn’s test, $p\text{-value} = 0.005$).

Holding the ears back while foraging percentages differed depending on the access level of the F-movement variable (Kruskal–Wallis rank-sum test, $p\text{-value} < 0.001$, Table 4). Horses living exclusively in the box had a higher percentage of backward ears while foraging than horses living mainly in the box (Dunn’s test, $p\text{-value} < 0.001$, Table 4). There was a tendency showing that horses living more often on pasture or paddock than in box presented the ears back while foraging less often than horses living exclusively in box (Dunn’s test, $p\text{-value} = 0.07$, Table 4) but not than horses living mainly in box (Dunn’s test, $p\text{-value} = 0.29$, Table 4).

Watching percentages differed depending on the access level of the F-movement variable (Kruskal–Wallis rank-sum test, $p\text{-value} = 0.01$, Table 4). Horses living in box exclusively showed a higher percentage of watching behaviour than horses living mainly in box (Dunn’s test, $p\text{-value} = 0.006$, Table 4) but not with horses living more in pasture or paddock than in box (Dunn’s test, $p\text{-value} = 0.23$, Table 4). No difference in the watching behaviour percentage between horses living mainly in box and horses living more in pasture or paddock than in box has been shown (Dunn’s test, $p\text{-value} = 0.30$, Table 4).

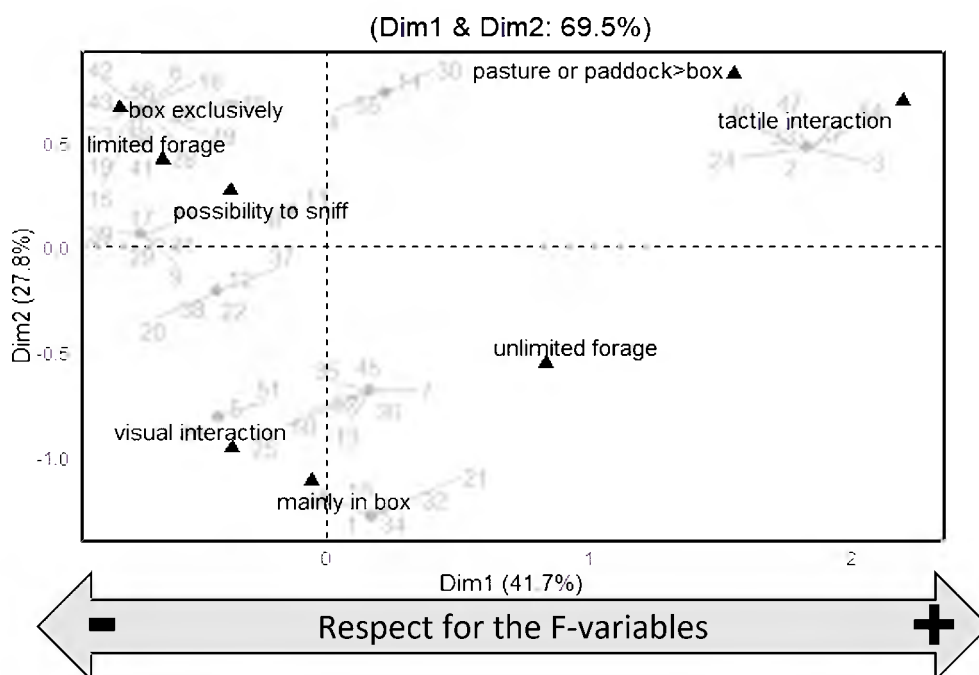


FIGURE 1

Multiple correspondence analysis (MCA) plot of the F-variables. The grey points and numbers correspond to the individuals.

Alopecia scores differed depending on the access level of the F-movement variable (Kruskal–Wallis rank-sum test, p -value = 0.001, Table 4). Horses living exclusively in box show a greater alopecia score than horses living mainly in box (Dunn's test, p -value = 0.001, Table 4) and horses living more in pasture or paddock than box (Dunn's test, p -value = 0.02, Table 4). No difference was found between horses living more in pasture or paddock than box and horses living mainly in box (Dunn's test, p -value = 1, Table 4).

3.5 Effect of “access to social interaction” categorisation (F-social)

There is a tendency to show that the percentages of abnormal behaviour differed depending on the access level of the F-social variable (Kruskal–Wallis rank-sum test, p -value = 0.06). Horses that had only visual interaction with other horses showed a higher percentage of abnormal behaviour compared to horses that could experience tactile interaction with other horses (Figure 2, Dunn's test, p -value = 0.031). No difference was found between horses that had the possibility to sniff other horses and horses that could have visual interaction with other horses (Figure 2, Dunn's test, p -value = 0.38). No difference was found between horses that had the possibility to sniff other horses and horses that could have tactile interaction with other horses (Figure 2, Dunn's test, p -value = 0.16).

No difference was found between the different levels of the F-social variable and behavioural measures as the percentage of backward ears while foraging (Kruskal–Wallis rank-sum test, p -value = 0.11, Table 4) or the percentage of watching behaviour (Kruskal–Wallis rank-sum test, p -value = 0.40, Table 4).

No difference was found either between the social interaction levels and the alopecia score (Kruskal–Wallis rank-sum test, p -value = 0.25, Table 4).

4 Discussion

High-level sport horses have very unique uses and living conditions. They are intensively trained from an early age to maintain optimum physical condition, travel extensively around the world to compete at the highest level, and are closely monitored by their vets and grooms to avoid injuries and optimise their weight. This study shows that there exists a large variability among horses regarding their access to forage, freedom of movement, and social contact, with some horses experiencing a lot of restrictions while other do not, meaning that it is possible to respect the needs of horses related to 3Fs while competing at a high level. Second, we observed that the fewer restrictions the horses experience regarding the 3Fs while in their home stables, the better their welfare is, as demonstrated by the indicators we assessed.

4.1 Applying the 3Fs is essential to the welfare of high-level sport horses

The significant correlation between dimension 1 of the ACM, which can be interpreted as a global indicator of respect for the 3Fs variables (access to forage, freedom of movement, and social interaction with conspecifics), and the abnormal behaviour ratio, the backward ears ratio while foraging, and the alopecia score shows that adherence to the 3Fs variables is strongly associated with improved welfare indicators in high-level sport horses. Specifically, horses that

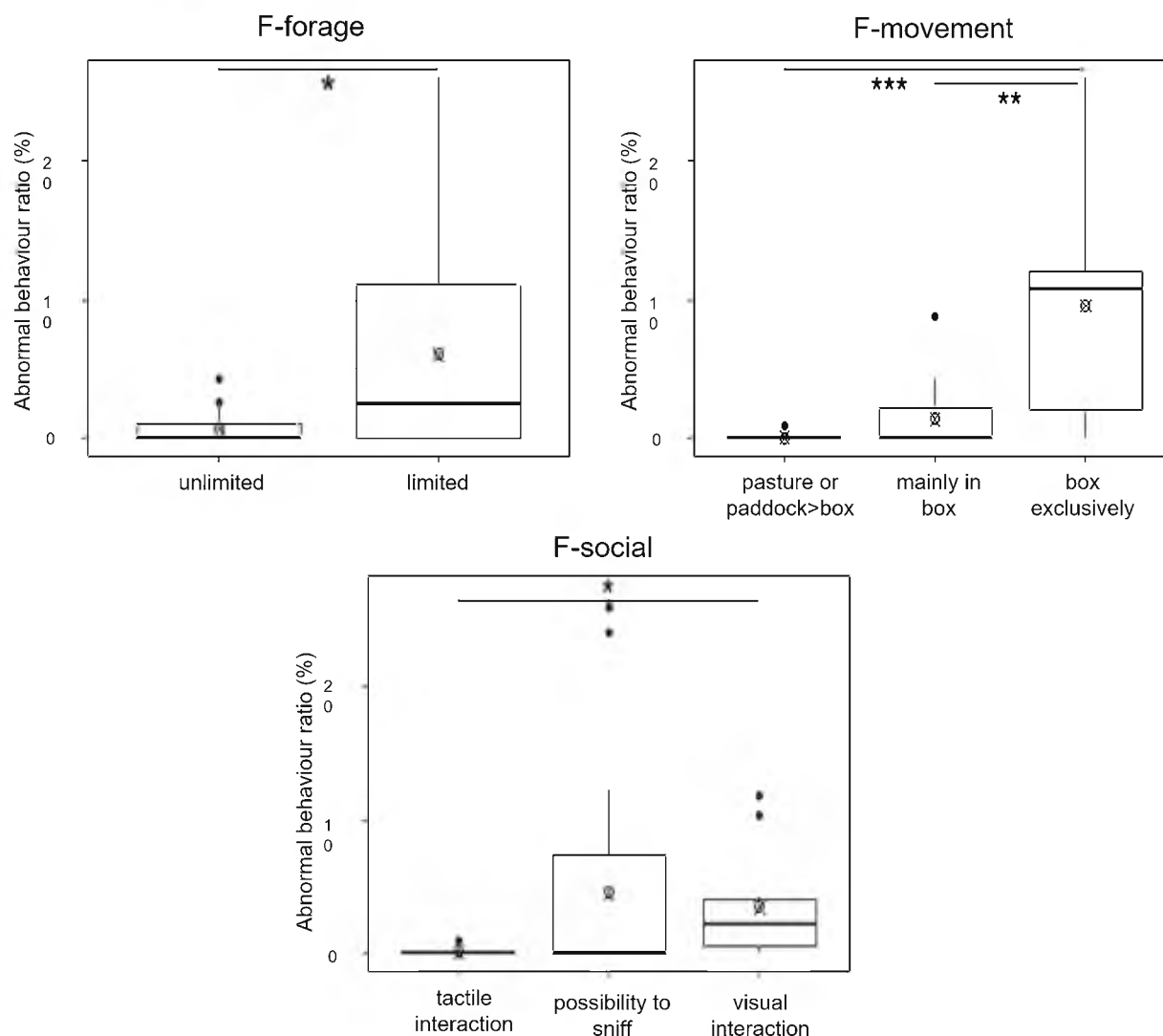


FIGURE 2

Median value, mean value (crossed circle), and interquartile ranges of the percentage of abnormal behaviour ratio depending on the F-forage: limited ($N = 32$) or unlimited ($N = 24$), on the F-movement: pasture or paddock > box ($N = 12$), mainly in box ($N = 22$), and in box exclusively ($N = 22$), and on the F-social: tactile interaction ($N = 8$), possibility to sniff ($N = 33$), and visual interaction ($N = 15$), * p -value < 0.05, ** p -value < 0.01, and *** p -value < 0.001. The abnormal behaviour ratio was calculated as the number of abnormal behaviour observations/total observations.

have greater access to these fundamental needs exhibit fewer abnormal behaviours, display more positive emotional states while eating, and even show better physical condition as evidenced by less alopecia. The detailed analysis of each of the 3Fs variables confirms this result and provides more specific insights into the effects of each of them, although it is important to keep in mind that these variables are interconnected.

Horses with unlimited access to forage exhibited little or no abnormal behaviour contrary to those with restricted access. Our findings support the main theories on equine feeding practices, which state that reducing the time spent eating affects the mental health of horses (38). In addition, horses with limited forage held the ears backward while foraging more compared than those with unlimited forage, which is a sign of a negative emotional state (32) and is uncommon to observe in naturalistic conditions (25). Finally, the high rate of watching behaviour in horses with limited forage could be explained by the fact that the horse's main activity

in terms of its time budget is eating (18), so not being able to perform this activity must be disruptive. The high rate of observation behaviour may also be attributed to the anticipation of the subsequent feed distribution. This is in accordance with the findings of the experimental setup, which indicated that this type of behaviour is more prevalent during the cue-arrival food phase (39). This raises the question of whether these horses, which observe their environment with greater frequency than others, at the expense of certain other behaviours, such as resting or eating, would perform redirected behaviours that could eventually develop into alert behaviour, which is an abnormal behaviour (Table 1). Unlimited forage is therefore essential for the welfare of high-level sport horses.

The second studied variable related to the freedom of movement. The more the horses had access to pasture or paddock, the less abnormal behaviour they exhibited. This finding is in line with a study of daily paddock access, in which horses were released into paddocks

TABLE 4 Relationship between behavioural and physical measures according to the F-variables.

F-forage	Behavioural measures			Physical measure
	Abnormal behaviour ratio	Backward ears ratio while foraging	Watching behaviour ratio	Alopecia score
Limited forage	0 [IQ1: 0, IQ3: 4] ^a	0 [IQ1: 0, IQ3: 5] ^a	12.5 [IQ1: 7.47, IQ3: 21.21] ^a	6 [IQ1: 4, IQ3: 13.5]
Unlimited forage	0 [IQ1: 0, IQ3: 3.75]	0 [IQ1: 0, IQ3: 5]	12.5 [IQ1: 7.62, IQ3: 20.6]	6 [IQ1: 4, IQ3: 13.5]

F-movement	Behavioural measures			Physical measure
	Abnormal behaviour ratio	Backward ears ratio while foraging	Watching behaviour ratio	Alopecia score
Pasture or paddock > box	0 [IQ1: 0, IQ3: 3.75] ^b	0 [IQ1: 0, IQ3: 5]	12.5 [IQ1: 7.62, IQ3: 20.6]	6 [IQ1: 4, IQ3: 13.5] ^b
Mainly in box	0 [IQ1: 0, IQ3: 3.88] ^b	0 [IQ1: 0, IQ3: 5] ^b	12.18 [IQ1: 7.54, IQ3: 19.62] ^b	5 [IQ1: 4, IQ3: 13] ^b
Box exclusively	0 [IQ1: 0, IQ3: 4.06]	0 [IQ1: 0, IQ3: 5]	12.82 [IQ1: 7.15, IQ3: 21.24]	7 [IQ1: 4, IQ3: 14]

F-social	Behavioural measures			Physical measure
	Abnormal behaviour ratio	Backward ears ratio while foraging	Watching behaviour ratio	Alopecia score
Visual interaction	0 [IQ1: 0, IQ3: 4] ^c	0 [IQ1: 0, IQ3: 5]	12.5 [IQ1: 7.47, IQ3: 20]	15 [IQ1: 3.75, IQ3: 13.25]
Possibility to sniff	0 [IQ1: 0, IQ3: 4]	0 [IQ1: 0, IQ3: 5]	12.5 [IQ1: 7.47, IQ3: 21.21]	6 [IQ1: 4, IQ3: 13.5]
Tactile interaction	0 [IQ1: 0, IQ3: 3.88]	0 [IQ1: 0, IQ3: 5]	12.5 [IQ1: 7.47, IQ3: 21.21]	5 [IQ1: 4, IQ3: 13.5]

For the F-forage part: Mann–Whitney test, median [Interquartile 1, Interquartile 3]. If followed by the upper case “a” (e.g., median [IQ1, IQ3]^a), it indicates a significant difference with horses with unlimited access to forage. For the F-movement and the F-social parts: Kruskal–Wallis rank-sum tests, median [Interquartile 1, Interquartile 3]. If followed by the upper case “b” (e.g., median [IQ1, IQ3]^b), it indicates a significant difference with horses living in box exclusively. If followed by the upper case “c” (e.g., median [IQ1, IQ3]^c), it indicates a significant difference with horses that have the opportunity to fully interact with other horses.

(4). Letting a horse out freely, even for a short time, can be very beneficial (1, 4, 7, 16, 19, 40). In fact, as little as 1 h a day, 5 days a week can already improve a horse’s welfare (4). Furthermore, horses that live exclusively in boxes are the ones that show more backward ears while foraging. This finding complements what was observed in the study where horses released into the paddock every day showed fewer backwards ears while foraging than those kept in boxes (4). These horses were also more observant than the others. One study showed that sport horses showed a higher frequency of standing alert behaviour when they were not turned out (8). In our study, we found that watching behaviour increased in horses kept exclusively in boxes compared to those living mainly in boxes. The positive impact of freedom of movement is evident even among high-level horses, despite their unique lifestyle.

Finally, our results show that high-level sport horses also need a high level of social contact. Our study revealed that horses that could only visually interact with other horses exhibited more abnormal behaviours than horses that could fully interact with other horses. Interestingly, although there are no significant differences, we found that horses that were only able to sniff other horses showed more abnormal behaviour than all other horses studied. In general, horses start by sniffing each other before engaging in social interaction as odours are a source of information about other horses (41). However, as only being able to smell a conspecific limits social interaction, we can question whether there is frustration in not being able to fully realise social interaction. Therefore, it would seem to be beneficial for the horse to be able to have tactile contact with other horses, even if this means partially nibbling each other across the boxes or paddock. Our results did not show that horses showed more ears backwards while foraging or more watching behaviour depending on the level of social interaction available, and this effect was more evident for abnormal behaviours.

The high-level sport horses whose living conditions best respect the needs for 3Fs (Forage, Freedom, and Friends) are those that show little to no signs of poor welfare. Compared to the other variables, social interaction has a slightly lesser impact. However, we believe this is related to the characteristics of our study population: Indeed, we have few horses with full access to conspecifics. With a different sample, with more horses that could have tactile interaction with conspecifics, this variable might have shown a greater impact. In conclusion to this first part, respect for the 3Fs is therefore essential for the welfare of these horses when they are in their stables.

4.2 Assuring the 3Fs is possible for high-level sport horses

Respect for 3Fs seems both necessary and possible. In fact, our study revealed that high-level stables already respect the 3Fs. Our study, based on voluntary sampling rather than probabilistic sampling, does not allow us to generalise the obtained proportions to the entire high-level equestrian sector. However, it does demonstrate that it is possible to reconcile adherence to 3Fs with competing at the highest level, including at the Olympic Games. In fact, some of the horses in our study whose living conditions complied with the 3Fs even won medals at the Paris 2024 Olympic Games. Moreover, the strong collinearity we found between the variables access to forage, freedom of movement, and social interaction with conspecifics shows that stables that respect one of these criteria also respect the other two. This suggests that it is possible to respect the 3Fs in the management of stables for high-level sport horses, yet this was not in evidence when talking to professionals in the equestrian world.

When it comes to forage, one of the arguments against unlimited access is often the fear that horses will gain too much fat. However, in

our study, unlimited access to hay did not appear to have an effect on the body fat mass of elite sport horses, whereas hay restriction is known to have many negative consequences for the horse (10, 11, 42). This may be explained by the fact that high-level sport horses are involved in intensive sporting activity and are therefore less likely to gain weight. In the light of these findings, we therefore promote access to hay *ad libitum* for high-level sport horses.

One of the most interesting findings is the fact that horses living exclusively in boxes are the most injured (in terms of alopecia scores) compared with those living mainly in boxes and those living more in pastures or paddocks. This is a surprising result as it is generally thought that the opposite is true and that horses that are allowed to go out freely are the most likely to be injured. Indeed, this is one of the arguments for maintaining horses in boxes (43). However, one study demonstrated that, rather than age and sex being the primary factors influencing the incidence of injury, the breed had a more pronounced effect, thus suggesting that horses can be effectively maintained in groups comprising individuals of varying age and sex (44). Movement is essential for the welfare of the horses, and not providing this need can cause stress (4). It is therefore possible that the effect of living exclusively in a confined space could lead to an increase in the incidence of self-inflicted injury of these horses when they are expressing abnormal behaviours compared to horses that have the opportunity to move freely outside.

Our results also showed no difference in the body condition scores depending on the condition in which the horses are housed. Access to grass in the paddocks and pastures does not lead to greater weight gain. This finding is therefore an argument in favour of greater access to freedom of movement outside work, training, or exercise times for high-level sport horses.

Because of their value, sport horses are generally housed alone because of the risk of injury to each other. However, in our study, we found that the level of social contact had no impact on alopecia scores. This may be a reflection of the attention paid by the staff around these horses knowing the affinities between each horse. New systems are now possible to encourage this type of interaction, even for stallions that are usually isolated, such as converting boxes into social boxes (45). These devices enable horses to remain in individual accommodation but still have close tactile social contact with their neighbouring conspecifics when they want to.

Finally, the level of social interaction did not have an effect on the body condition score. As in some studies, isolation would lead to less feeding behaviour (20), a lower body condition scores for horses that only had visual interaction with others could have been observed. As the collinearity of our three variables was very strong, the horses that had only visual interaction were also the ones that were restricted in forage. In general, horses with limited access to forage are those that are fed high-concentrate diets (46), which may explain why there is no difference in their weight.

It should be noted that the present study was conducted with some limitations. As it was a field study, no reliability was conducted on the collected data due to time constraints at the private stables. In addition, the behaviour of the horses was observed on 1 day in their usual environment, which could have included the horse being in a box, paddock, or pasture. However, the findings of the study are nevertheless worthy of consideration. It is therefore necessary and possible to comply with the 3Fs as extensively as feasible with regard to high-level sport horses as they considerably enhance the level of welfare. The importance

of the 3Fs must therefore be communicated as widely as possible to the institutions, organisations, and people involved in the equestrian industry including some key recommendations. It is therefore important to ensure that the fundamental needs of the sport horse, represented by the 3Fs, are met. This can be achieved by providing the horse with *ad libitum* forage throughout the day, allowing for daily extended periods of turnout outside of work, and ensuring that the horse has daily social interaction with its peers.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: <https://doi.org/10.57745/HLNFN3>, INRAE data repository.

Ethics statement

The animal studies were approved by Val de Loire Ethical Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent was obtained from the owners for the participation of their animals in this study.

Author contributions

RP: Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Visualization. NH: Formal analysis, Investigation, Writing – review & editing. AR: Investigation, Writing – review & editing. AB-M: Writing – review & editing. AG-B: Writing – review & editing, Formal analysis. LL: Investigation, Supervision, Validation, Writing – review & editing, Funding acquisition.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that Generative AI was used in the creation of this manuscript. During the preparation of this study, the author(s) used ChatGPT and DeepL Write to check the grammar, syntax, and spelling of the manuscript. After using this tool/service, the author(s) thoroughly reviewed and made necessary edits to the content and assume(s) full responsibility for the final publication.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fvets.2024.1504116/full#supplementary-material>

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Review

The Contribution of Equitation Science to Minimising Horse-Related Risks to Humans

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Simple Summary: Equitation science describes an approach to horse training and riding that focuses on embracing the cognitive abilities of horses, their natural behaviour, and how human riders can use signalling and rewards to best effect. This approach is concerned with both horse welfare and rider safety, and this review discusses how equitation science can minimise risk to humans around horses and enhance horse welfare.

Abstract: Equitation science is an evidence-based approach to horse training and riding that focuses on a thorough understanding of both equine ethology and learning theory. This combination leads to more effective horse training, but also plays a role in keeping horse riders and trainers safe around horses. Equitation science underpins ethical equitation, and recognises the limits of the horse's cognitive and physical abilities. Equitation is an ancient practice that has benefited from a rich tradition that sees it flourishing in contemporary sporting pursuits. Despite its history, horse-riding is an activity for which neither horses nor humans evolved, and it brings with it significant risks to the safety of both species. This review outlines the reasons horses may behave in ways that endanger humans and how training choices can exacerbate this. It then discusses the recently introduced 10 Principles of Equitation Science and explains how following these principles can minimise horse-related risk to humans and enhance horse welfare.

Keywords: horse-riding; ethology; safety; equitation science; learning theory

1. Introduction

Equitation science is defined as the art and practice of horsemanship and horse-riding [1]. It is based on the founding principle of promoting the use of an evidence-based approach to explain and emphasise best practice in horse training and riding [2]. It is an inclusive system that aims to embrace all forms of training that are effective and ethical [3]. Equitation embraces a cost-benefit approach to ethics. The greater the impact to horses of a practice, the stronger the justification for that practice needs to be [4]. Ideally, all impacts could be considered moderate or less [4,5]. It also offers guidelines about what may be considered ethical. For example, positive punishment is where a noxious stimulus is used to suppress behaviour. This is discouraged in ethical equitation, as will be discussed later in this article. The uptake of ethical equitation has been broad and encouraging, but there has been some resistance for various reasons, such as the attitude of riders towards science, a preference for instruction from those successful at elite levels, and an emotional appreciation for finding harmony with horses organically [6]. Clearly, traditional approaches to riding instruction have been recorded

over centuries in the teachings of the so-called ancient masters [7,8] as well as more contemporary horse trainers [7,9]. Many of these approaches, but not all, withstand scientific scrutiny [10].

Equitation science has a strong focus on horse ethology, acknowledging the way horses learn and their adaptive behavioural tendencies [11]. In this way, riders and trainers can be guided to work with horses in ways that are within the species' cognitive limitations [12]. This is particularly important because horses and humans have different cognitive abilities [13]. Humans tend to attribute their own cognitive abilities to non-human animals [14–16], which can lead to unrealistic expectations about how quickly a horse can learn. The use of a concept such as “respect” may be important to the human but have little meaning for the horse. When training animals, trainers may become frustrated or assign human values and intentions to what are natural horse behaviours or cognitive limitations [17]. This in turn could lead to horse behaviour being misinterpreted as being deliberately challenging or wilfully disobedient, and the trainer adopting punishment to correct it [18]. Punishment is likely to impact negatively on equine welfare, but may also shift the focus of the horse to finding safety and relief from conflict rather than performing cued behaviours that are not relevant to their current goals [19]. This could lead to defensive behaviours or flight responses that threaten the safety of horse riders and trainers. Indeed, horse-riding is known to be a more dangerous activity than motorcycling, with most injuries occurring to the head, trunk, vertebrae, and wrists [20].

2. Causes of Dangerous Behaviour in Horses

2.1. Flight Responses

Like many animals, horses are often at their most dangerous both to themselves and to humans when highly aroused and attempting to escape perceived danger [21]. Horses are a large prey species reliant chiefly on flight at speed to keep themselves safe. This poses a problem for them in many human–horse interactions, as it is common for horses to be confined or restrained to varying degrees when around humans [22]. Being contained where the horse is worked with or housed reduces a horse's options for gaining safety. If sufficiently aroused, it may run blindly into fences or other structures, or into humans [23]. More commonly, inability to escape may pressure the animal into experimenting with confrontational behaviours such as charging, striking with hooves, and biting [24]. These behaviours are likely to meet with some success, since humans confronted by a large, aggressive animal will naturally prioritise their own safety and attempt to escape by retreating [23]. The alternative is for the human to meet confrontation with escalated aggression and intimidate the horse into withdrawal. The consequences of these actions are potentially serious. In the former scenario, the horse's aggressive behaviour is negatively reinforced by the human retreating, (*i.e.*, this has proved a successful way for it to create the space it needs to feel safer), or to avoid an event it had anticipated and found threatening or noxious [25]. Not only is this dangerous for the human, but it probably also perpetuates heightened arousal and negative emotional states in the horse [3]. Emotional conditioning may result in humans and/or training scenarios acting as signals for horses to become aroused and avoidant, or vigilant in anticipation of negative outcomes. Such anticipation primes animals to respond more strongly to aversive stimuli [26] and to interpret ambiguous signals as more likely to be potentially threatening [23]. This is unlikely to be comfortable for the horse, and is likely to trigger further defensive, high-arousal behaviours [12]. Furthermore, behaviours that have resulted in successful avoidance of an anticipated aversive experience can quickly become entrenched and very difficult to eliminate [27]. Deviating from avoidance behaviours known to be successful increases risk, so persistent avoidance behaviours are adaptive [28]. Re-training a horse that has learned undesirable avoidance or distance-increasing behaviours may prove challenging [29].

Punishing avoidance or distance-increasing behaviours is a strategy that comes with its own significant risks. If it is accepted that horses are at their most dangerous when trying to escape, then introducing further threats to a horse's sense of safety in the form of pain, or eliciting flight responses with predatory behaviour, such as chasing, stalking, and sudden movements, could potentially

contribute to the underlying problem rather than improving it [19]. While punishment may successfully suppress some dangerous behaviours, it may serve to heighten the horse's arousal and negative emotional state while around humans, which could lead to the expression of other unsafe behaviours that have not been specifically punished [30]. Unwelcome behaviours may represent manifestations of the combined effects of arousal and emotional state.

2.2. Confusion and Conflict

A horse cannot necessarily read the intentions of its rider or trainer. There are many ways a rider or trainer's behaviour can induce confusion. For example, signals may be unclear or inconsistent, or the horse may be unaware of how to reduce pressure imposed on it, or what the consequences may be [31]. This confusion can lead to a horse becoming conflicted, with opposing motivations, such as both approach and avoidance competing to manifest as its behavioural response. Such a horse may become uncertain of which behavioural response to adopt and, if arousal is elevated, this could prompt it to experiment with inappropriate locomotory responses such as bolting, bucking, rearing or shying [32]. Such loss of predictability and controllability may render the horse increasingly insecure, repeating the cycle of conflict and further endangering the rider.

2.3. Frustration

Aggression has often been shown to stem from frustration [33]. In applied ethology, the term frustration is used to describe thwarted motivation [34–36]. In horses, frustration may be caused by them being unable to perform natural behaviours due to restraint [37]. It is believed that frustration may be responsible for some stereotypies and self-injurious behaviours [38,39], but it may also negatively affect a horse's behavioural inhibition and acceptance of handling procedures that might normally be tolerated [40]. Frustration can also arise during training in-hand and under-saddle, when reinforcement is inconsistent or non-existent and, as a result, horses are confused about how to escape pressure applied to them, or access other reinforcers, or avoid punishment [31]. This may have the effect of reducing self-regulation and increasing ambivalence so that horses may attempt to escape, becoming aggressive towards objects around them, including humans, or, alternatively, they may resort to apathy.

3. The 10 Principles of Ethical Equitation

Equitation science focuses on interacting with and managing horses in ways that avoid provoking dangerous behaviour in the first place [20]. This circumvents the aforementioned problems that can arise when addressing dangerous horse behaviours. Avoiding flight responses and minimising confusion and frustration in horses are the cornerstones of promoting safe behaviours and avoiding dangerous behaviours in equitation. Equitation science seeks to apply scientifically obtained data to training and riding horses to improve the safety and wellbeing of both horse and rider. It is not a single system or method, but it allows all methods of horse handling, training and riding to be assessed on the basis of a cost-benefit analysis that embraces their effectiveness and humaneness. There are significant challenges in empirically assessing the relative merits of approaches that are underpinned by the International Society for Equitation Science (ISES) principles because many other approaches to training include elements that align with these principles. If equitation does indeed guide horse riders and trainers towards safer interactions with horses, it is difficult to justify encouraging a deviation from this path simply to test its validity. Seeking horse riders who embrace either all of the principles of equitation science or a consistent subset of them to comparable degrees and skill in application remains problematic, so there are few data to support the effectiveness of the following ISES principles in isolation, (but any data that are available are cited). The cornerstones of promoting safety in equitation manifest in ISES's recently released 10 Principles of Ethical [41]. They are as follows:

1. Train according to the horse's ethology and cognition.
2. Use learning theory appropriately.

3. Train easy-to-discriminate signals.
4. Shape responses and movements.
5. Elicit responses one-at-a-time.
6. Train only one response per signal.
7. Form consistent habits.
8. Train persistence of responses (self-carriage).
9. Avoid and dissociate flight responses (because they resist extinction and trigger fear problems).
10. Demonstrate minimum levels of arousal sufficient for training (to ensure absence of conflict).

This article explains how these principles can minimise horse-related risks to humans as well as the welfare implications for horses.

3.1. Train According to the Horse's Ethology and Cognition

Ethology is the study of animal behaviour in light of how a species has evolved to live. A horse's ethology informs what is known of horse social structures, including complex, dynamic social organisation with social rank determining which individuals receive priority access to resources. Equine ethology also shows that horses readily form attachment bonds and need the company of their own species, so isolation is detrimental [42]. A horse that is in an inappropriate social group may be less responsive during training and, equally, a horse that has encountered inconsistent training may be more likely to be distressed by marginally frustrating aspects of its world when not being ridden [3]. Horses have evolved to graze for about 16 h a day, which means they are moving for much of the day [29,43]. This has implications for horse management, as restricting physical movement ignores the motivation horses have for locomotion, and may result in frustration, post-inhibitory rebound [44] and subsequent behaviour problems [45].

Cognition refers to the ways animals process information about the world. The equine prefrontal cortex is comparatively small to that of a human [46], so horses and humans may recall events differently from the way humans do [47]. Horses have evolved as prey animals that must be constantly aware of potential dangers, so they have developed excellent abilities to recognise stimuli that trigger responses such as the flight response [13]. Equine and human intelligence are qualitatively different, so care must be taken not to overestimate what they can perceive when it comes to which behaviours are "right" or "wrong" [12]. It is likely that incorrect behaviours are a product of training rather than a horse being wilfully disobedient. Equally, horses, like other animals, can develop emotional responses to stimuli that motivate their behavioural responses [48], so it is important not to underestimate their ability to react in a highly emotional way, which can make them unpredictable and dangerous, and have a significant impact on their welfare and willingness to work with humans [49,50].

Understanding equine ethology and cognition can help keep riders and trainers safe by helping them to appreciate what is most important to horses from moment to moment [51]. Understanding that horses must be vigilant and react very quickly to potential threats explains why they may be highly attentive to stimuli that signal threat, or even stimuli unfamiliar to them [29]. It is safer to assume that there is danger and act in the interests of self-protection than to assume that there is no danger and risk being injured or killed [52]. While a horse's safety is dependent on speed, their agility is limited in small spaces by their size. This should inform those working with horses that, in the face of threat, horses will have an urge to run, and the more startled or frightened they are, the more powerful this urge will be [20]. They often run without any apparent regard for their own safety, seemingly when above certain arousal thresholds to be unable to notice or process how to navigate obstacles. If they are not so aroused as to flee in this way, they may be able to trial alternative behaviours to reduce the perceived threat. However, the more aroused they become, the more they will default to natural, energetically and pathologically costly behavioural solutions.

The ability to predict how horses may respond to threatening stimuli is a feature of what is known as horsemanship [53] and, as such, it arms riders and trainers with valuable information against

provoking dangerous horse behaviour. Understanding ethology can also help predict the kinds of stimuli that may provoke extreme responses in horses. Horses are neophobic, so any unfamiliar stimuli may be perceived as potentially threatening, and young and/or inexperienced horses are likely to be triggered to escape by stimuli to which more-experienced horses may have habituated [20]. Furthermore, a horse that has been triggered to escape is likely to recognise the stimuli that started this response very well, and may also recall other contextual stimuli, and associate them with the flight response [31]. This could result in a horse being triggered to escape by stimuli to which it had been previously habituated. Addressing these strong and problematic associations takes patience and care to slowly build up a horse's tolerance to stimuli that have previously set off a flight response [31].

Appreciating the social and locomotive needs of horses and being sure to meet them aids in avoiding frustration. Frustration can be a serious problem, as it can foster aggression [33].

3.2. Use Learning Theory Appropriately

Learning theory informs the ways horses learn that are common to all animals, and includes habituation, sensitisation, operant conditioning, shaping, and classical conditioning [25].

Habituation is recognised when animals stop responding to events and stimuli as they become accustomed to them. As discussed above, horses are innately neophobic and often find characteristics such as the size, novelty, proximity and sudden appearance of stimuli frightening or startling [54]. Movement may mimic more threatening stimuli, such as stalking or rushing predators or conspecifics, particularly if it is sudden, erratic, or advancing towards the horse [3]. This may overcome even familiar stimuli and provoke unexpected responses. Habituation can reduce the intensity of reactions to aversive stimuli and be facilitated by desensitisation. For example, horses may be gradually exposed to an aversive stimulus with increasing intensity while ensuring that they remain in a calm state [55]. The horse learns that a calm response is more relevant than an aroused and fearful response.

Sensitisation is when an individual's response intensity is increased. In contrast to desensitisation, repeated exposure to arousing stimuli results in an increased likelihood of a response of increased speed or intensity to other stimuli as well. Being able to recognise this process when it is occurring is important when managing a horse during exposure to potentially threatening stimuli. It is worth noting that sensitisation to pressure cues from the rider is often desirable in equitation [56].

Operant conditioning describes training using rewarding or aversive consequences. Such consequences are shown to be either reinforcing or punishing by their effect on the preceding behaviour. Therefore, if behaviour reduces in frequency, duration or intensity, the behaviour has been punished, whereas if it increases in frequency, duration or intensity, it has been reinforced. A behaviour can be punished by *applying* a noxious stimulus, which is known as positive punishment, or by *removing* a desired stimulus, which is known as negative punishment. Similarly, positive reinforcement describes the addition of a desired stimulus, and negative reinforcement the taking away of a noxious stimulus. It is important to understand which of the four operant processes is taking place. Punishments suppress behaviour, and may have suppressive effects not only on the behaviour that was punished, but also on contextual aspects and the horse's future willingness or unwillingness to offer new behaviours [57]. In contrast, reinforcement encourages behaviours, particularly approach behaviours, when the reinforcement used is positive reinforcement [58]. Negative reinforcement is used extensively in horse-riding, with physical pressure being applied to parts of the horse's body and being released when the desired behaviour is performed [57] (*i.e.*, the release of pressure is reinforcing). It is therefore imperative that the release of pressure be prompt, consistent, and easily achieved by the horse [3]. Negatively reinforced responses that rely on aversive stimuli (such as most rein or leg signals) should be continuously checked and maintained in order to avoid problem behaviours that may lead to reduced welfare [31] (*i.e.*, so that the horse does not habituate to the aversive stimulus).

Shaping is the gradual step-by-step building of behaviours, by reinforcing each step. The targeted behavioural goal is achieved by rewarding successive approximations so that each step should differ only slightly from the previous step [57]. The advantage of this approach is that it enables horses to

have many successes on the way to learning the final behaviour, which is likely to encourage positive emotional states associated with training [31].

Classical conditioning uses cues and signals to trigger and elicit behaviours. They must be precisely timed to coincide with the start of the desired behaviour, and in that way, over time, they become cues that predict and trigger the desired behaviour [59].

It is critical to use learning theory appropriately and with skill. The implications of using it incorrectly are broad. The use of aversive stimuli in training to punish a behaviour are likely to negatively impact the horse's mood [60]. Where an animal's experiences are frequently aversive, it will expect more aversive experiences. This may make it more flighty and defensive. Furthermore, incorrect use of operant conditioning and errors in shaping can lead to frustration, which can, in turn, lead to aggression or conflict behaviours [31]. Understanding how habituation, sensitisation, and classical conditioning work and having the ability to correctly identify when these processes are taking place enables riders and trainers to avoid horses developing negative associations with training-related stimuli and encourages horses to build positive or neutral associations. Negative associations lead to negative moods [50], triggering potentially dangerous problems that have already been discussed, such as vigilance, hyper-reactivity, and conflict.

3.3. Train Easy-to-Discriminate Signals

Operant and classically conditioned signals should be unique and easily discriminated, particularly for signals that modulate behaviours in opposite directions [25]. Some examples are up/down gait transitions and faster/slower gait variations. Signals that are blurred or ambivalent may lead to horses becoming confused and distressed, particularly if the consequences of error are aversive, such as the application of punishment, increased pressure, or apparently inescapable pressure [61]. This could produce frustration and conflict with its associated dangers, but may also, paradoxically, lead to an incorrect response, particularly when training behaviours that are relatively novel. When both the correct and incorrect response have been reinforced, confusion may manifest as either a default to commonly practised behaviours or a reversion to stress-related behaviours, such as escape, aggression or apathy. Furthermore, similar signals for different responses may lead to the horse offering the opposite response to what was requested. For example, if the conditioned stimulus for moving the legs both "faster" and "slower" are similar (because the rider's legs are involved in both responses), then an incorrect discrimination is likely to lead to the horse increasing or decreasing speed when asked to do the exact opposite. Such confusion can lead to dangers for humans and can have welfare implications for horses.

3.4. Shape Responses and Movements

Training should begin by reinforcing any rudimentary attempts at the target behaviour [62,63] that of course is completely unknown to the horse. Expecting the horse to extrapolate the correct response can lead to confusion and frustration, and subsequent compromised welfare [64]. As discussed above, this has implications for the safety of riders and trainers as it increases the likelihood of aggressive or escape behaviours, but also may lead to decreased reliability in responding to signals, which could put both horse and rider in the path of immediate danger, particularly if the horse does not stop or slow when signalled [5].

3.5. Elicit Responses One-at-a-Time

Cues or signals should be given individually, with a clear separation between them. This ensures that contradictory or conflicting signals are not given simultaneously, which can lead to inhibition of both signalled behaviours [65], as well as behaviours declining in strength and, potentially, signals being confused. The timing of signals should also be considered so that signals closely align with the behaviours they are cueing. For example, horses have four fundamental gaits. In walk, there are four beats, in trot, two beats, and in canter, three beats. The optimal time to elicit a response is

when the leg is in swing phase because on the contrary stance phase, the limbs are preoccupied by mechanical constraints [66]. The implications for this are that there are four moments in walk swing phase in which to elicit an accelerating, decelerating or turning limb response, two moments in trot, and three in canter. This principle has the same implications for safety as shaping responses and using signals that are easy to discriminate between.

3.6. Train Only One Response per Signal

Each signal should elicit only a single response, so that it is clear to the horse which response is being signalled. In the dressage domain, rein stimuli are often used both to make the horse arch its neck, and for deceleration signals. In addition, rein cues signal the horse to turn, so tightening reins to bend the horse's neck could also mean deceleration, or an ambiguous turn signal. Finally, the rider's legs are frequently used for all the various locomotory effects as well as for turning and so called "bending" the horse's body. There is also a strong potential here for confusion, and this use of one signal for several possible responses also violates the next principle of consistency.

Training only one response per signal is especially critical when separating acceleration and deceleration signals, and signals for speed and direction. Ambiguous signals lead to confusion in the horse, and a variety of broader effects on behaviour. Evidence in humans shows that ambiguity is avoided as aversive [67], and it can produce context-specific responses in animals [68] that may result in horses performing behaviours that are unexpected by the rider and may be punished, or produce behaviours from the human that are unexpected by the horse. This may in turn lead to increased conflict behaviours, incorrect behaviour at critical moments, hesitation, frustration, aggression, and ongoing anxiety surrounding being ridden [20], all of which may produce horse behaviours that endanger riders. One response may have multiple signals, but those signals should be exclusive to the one response and not be used to elicit other responses [31].

3.7. Form Consistent Habits

Consistency is a powerful tool. From a training perspective, consistency in signals and what they mean across different contexts also leads to consistency in the horse's responses [25]. Clearly, this outcome is desirable, and enhances rider and trainer safety by promoting reliability in the horse's readiness and ability to perform behaviours smoothly and without hesitation when signalled [69]. Consistency in the trainer's approach to shaping so that successive steps always follow a similar pattern no matter what behaviour is being trained helps a horse to predict how training sessions will progress and the likely next steps that will be reinforced. This will reduce frustration, encourage positive affective states and promote persistence in shaping sessions so that the horse will not become frustrated or show a reduction in response rate when criteria change during shaping.

The same approaches that make consistency in and between training sessions beneficial may also promote safety outside training sessions. Consistency in the sequence of activities handlers and carers conduct around horses, the way they move, the way they vocalise, and when and how they interact with horses can allow these animals to predict the chain of events that are relevant to them [53]. This may be a double-edged sword, as it can produce sensitisation to stimuli in some circumstances, but where there are no stimuli producing powerful avoidance responses, it may have the opposite effect and habituate horses to everyday activities and routines [54]. Horses that can predict the immediately following events and know them to be safe are animals that will be more relaxed, less vigilant to potential negative stimuli, less prepared to take evasive or defensive actions or to attempt escape, and may be more exploratory and less fearful [23].

Inconsistent training and behaviour around horses can lead to the development of ambiguous signals that are difficult for horses to reliably interpret and respond to. This decreases their control of outcomes, leading to insecurity, which leads to diminished feelings of safety. This may compromise rider and trainer safety by creating horses that are skittish and unpredictable as they try to anticipate and adapt to surprising behaviour from humans.

3.8. Train Persistence of Responses (Self-Carriage)

Self-carriage refers to the maintenance of learned behaviours that should not need constant signalling or correction, but which the horse will continue performing until signalled otherwise [31,70]. If ongoing signals are required throughout the performance of a behaviour, it can have detrimental effects on signalling. It may lead to dull responses where signalling becomes meaningless background “noise” [59]. It may also lead to sensitivity and hyper-reactiveness to other stimuli. If a signal involves tactile pressure, and is not released when the horse begins to perform the correct behaviour, the horse does not know how to escape the pressure, and may experiment with undesired and dangerous behaviours, such as bucking [71]. Rider safety can be compromised in both scenarios. Equitation science encourages the use of sparse signalling as well as self-carriage of behaviours so that signalling does not become constant [3]. This is in the interests of the horse, as it does not put the animal in states of conflict, but it is also in the interests of the rider by avoiding hyper-reactivity or a drop in responsiveness.

3.9. Avoid and Dissociate Flight Responses (Because They Resist Extinction and Trigger Fear Problems)

Research has suggested that horses displaying a fear response (either flight or fight) feature prominently in horse-related injuries to humans [72]. Flight responses are related to seeking safety, and as such, have unique characteristics that have become adapted to keep horses safe and to find safety in the future. Flight responses are resistant to extinction, because threats to safety are serious and the potential cost of judging a stimulus safe when it is not could be injury or death [27]. In contrast, the cost of judging a stimulus unsafe when it is safe is likely to be less serious, such as missing opportunities for access to or learning about important resources (e.g., nutritious food, shelter, or mates). Flight responses are also prone to spontaneous recovery, even after alternative behaviours have been trained [27]. So, avoidance behaviours may continue even when the emotional need for avoidance is no longer driving the behaviour.

Flight responses are associated with a host of physiological and cognitive changes that are extremely effective at helping horses remove themselves from perceived danger and avoiding that danger in the future, but those same changes can be problematic in training and riding, as well as making horses unsafe [20]. High arousal and increased muscle tone make a horse very physically responsive to stimuli so they are primed to flight at the first hint of potential danger [73]. This is likely to give them the best chance of finding safety in the face of threats, but it is also likely to result in skittishness and unpredictable responses as they process stimuli through the filter of their state of high alertness. Furthermore, high arousal is damaging to the execution of problem-solving skills and concentration [50]. When an animal is in acute distress, such as that brought on by an urge to take flight, problem behaviours such as bolting, aggressive displays, distance-increasing behaviours, or apathy are likely to emerge [64]. These behaviours can be dangerous for horses and for humans working with or around them, and can also create instant negative associations with stimuli that the horses perceive when their need to escape becomes powerful [64]. The horse is also likely to become firmly entrenched in any behaviour that seemed to assist escape, which can mean that a horse learns to engage in dangerous behaviour to avoid perceived threats [71]. It may be that just the appearance of those perceived threats (e.g., someone approaching with a lead rope) can provoke avoidance behaviours that have been successful in the past even before there is any further indication of potential threat [43].

It is believed that when horses are often exposed to threatening stimuli, they can become chronically stressed [74] and that chronically elevated cortisol concentrations may result in health problems that reflect compromised immunity [75] but it can also come with a host of other potential problems that are likely to negatively impact performance and rider safety. These include learning and memory deficits, conflict behaviours becoming ritualised, redirected aggression, and long-term insecurity leading to problems such as separation-related distress, stereotypies, fear of conspecifics and heightened neophobia [76]. Chronically stressed horses may also develop a negative expectation bias, which can result in reduced interest in accessing reinforcers, and a subsequent cycle of negative

emotional states perpetuated by negative expectation bias and avoidance and escape behaviours. This cascade may prevent adjustment to expectations and lead to risk aversion that discourages the explorations that might give them access to reinforcers that could improve mood [74].

Thus, chronic stress can result in a horse that may be volatile and unpredictable, may behave aggressively, and present extreme escape behaviours that can unseat and injure riders. Such horses may also have difficulties learning alternative behaviours due to their negative expectations and their preoccupation with performing behaviours that have successfully delivered escape and safety in the past. Furthermore, high glucocorticoid concentrations associated with chronic stress can affect cognition and memory, enhancing memory consolidation for avoidance learning, but hampering recall of other memories [77]. Equitation science demands avoidance of provoking flight responses, which, arguably, present the most dangerous aspects of horse behaviour. Horses attempting to take flight may fail to notice humans in their way, may be compelled to barge past them, or may view them as an obstacle to escape that heightens their distress or provokes human-directed aggression [20]. It is important to realise that horses in such states are often incapable of responding to signals in the way they have been trained, and are probably prioritising their own safety. This usually means increasing their distance from fear-inducing stimuli by whatever means are available. Where they are unable to do this with escape behaviours, they may attempt to do so through aggression [37]. Furthermore, their focus on imminent danger is likely to lead them to misinterpret, signals, stimuli, and human behaviours that they may be both familiar and comfortable with as threatening.

Attempts at training alternative behaviours without addressing the cause of the flight response may introduce further conflict or may cause it to be expressed in new ways. In addition, the horse may identify additional threats, such as humans stalking or chasing it, and this risks the horse making a single-trial association between its high arousal state and stimuli it has formerly been comfortable with, including humans, mounting blocks, or tack [58].

Flight responses in horses are clearly dangerous on several levels. Equitation science emphasises avoiding provoking them in the first place, but where this has occurred, it is important to realise that such horses have probably also associated their threatened safety with stimuli or events that occurred or were present at the time of the expression of these flight responses [3]. Dissociating those signals from flight responses may be difficult and time consuming, with many trials needed, but it must be achieved, and with minimal further threats to the horse's perceived safety. This is why equitation science also recommends that the original source of a flight response and conflict be ascertained and addressed. For example, dysfunctions in negative reinforcement of deceleration responses require that these responses be retrained through the correct use of negative reinforcement or combined negative and positive reinforcement.

3.10. Demonstrate Minimum Levels of Arousal Sufficient for Training (To Ensure Absence of Conflict)

As discussed, arousal levels are associated with performance. The nature of the association depends on the task to be performed. If the task is complex, requiring assessment of options, problem-solving, precision, or self-control, the relationship can be described as curvilinear or an "inverted-U", (*i.e.*, the shape of a graph with performance on the y-axis and arousal on the x-axis), with poor performance when arousal is low and the quality of the performance increasing until arousal is at a moderate level before declining as arousal peaks [50]. At low arousal, performance is poor because arousal is linked to interest and motivation, which are needed for the investment of energy into a related task. Performance increases with arousal to reach its maximum at moderate arousal, where the optimal level of arousal promotes interest in performing the task and speed in performance without the detrimental effects of high arousal. Increases in arousal beyond its optimal level lead to ever-poorer performance, while at the same time facilitating bursts of speed or strength. This can be explained by attributes of animals in high arousal that may impair performance, such as increased muscular tonus reducing the capacity for precise movements, and the sharpening of focus onto a single task or stimulus that may make animals less attentive and unable to respond to other stimuli [78]. This means that highly

aroused horses may struggle to process signals not directly related to the salient stimuli, hampering problem-solving and the detection of and appropriate response to other external stimuli [3]. It also amplifies the veracity of the earlier mentioned Principle 5, that responses should be elicited singly.

There are several theories of arousal [79,80], and many attempt to account for deviations in this inverted-U pattern. It is posited that where the required task is simple and highly relevant to the consequences of performing it, higher arousal will generally improve performance in a linear fashion and there will be no dramatic decline at higher levels [79]. For example, where a horse's goal is to escape a noxious stimulus, increased arousal will increase heart rate and blood pressure, serving to increase speed. The horse's focus will narrow to fixate on escape routes. Such horses are now in a good state to get to safety as quickly as possible, but if they are required to perform a complex task in order to do so, such as negotiating a maze, they will need a lower level of arousal to accomplish their goal quickly and efficiently.

High arousal states may improve performance for simple, energetically costly behaviours, but it is possible that they come with additional risks other than lack of precision and impaired problem-solving and decision-making skills. Arousal is a state of readiness, so it follows that at higher levels it may come with ever-increasing likelihoods of very active behaviours, and an ever-increasing dependency on them to solve any problems or threats that may be encountered. In a large prey animal such as a horse, this could make them more prone to dangerous behaviours related to flight or aggression, regardless of why they initially became aroused. It is possible that being in the presence of an attachment figure may help them to moderate arousal [81]. As such, equitation science encourages trainers to aim for promoting the minimum arousal level required to perform the target behaviour [82]. Not only will this support the horse's ability to adapt to changing conditions appropriately and respond correctly even to unanticipated signals, but it will also reduce the likelihood of dangerous flight responses and aggressive behaviour in the case of conflict or when startled, and thus keep trainers and riders safer [20].

4. Conclusions

Horses can weigh more than 500 kg and are prone to strong flight responses. The danger they present when highly aroused and fixated on creating distance between themselves and perceived threats cannot be overstated. Those working with horses may inadvertently trigger flight responses, or be seen as a threat to be escaped from or driven away by horses, depending on environmental conditions such as available space or the presence of other threats. Humans can behave in ways that confuse, frustrate and frighten horses, or a combination of all three. Minimising the likelihood and strength of flight responses by managing a horse's arousal and emotional state is one element of the ISES 10 Principles of Equitation Science that may serve to guide human behaviour around horses to promote human safety. These principles also address training goals that serve to minimise frustration and confusion in horses during horse-riding and husbandry with best practice use of learning theory and an understanding of equine ethology. These principles are likely to enhance human safety by promoting consistency and responsiveness in horses and avoiding conflict during the training of new behaviours and signalling of known behaviours.

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Article

A Comparative Neuro-Histological Assessment of Gluteal Skin Thickness and Cutaneous Nociceptor Distribution in Horses and Humans

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Simple Summary: This study was performed to increase the understanding of the capacity of horse skin to detect pain when directly compared to human skin. The study focused on gluteal skin where horses are most often struck with whips during racing. The study was designed to inform the debate surrounding the use of whip strikes in horse racing where there is increasing pressure on the global racing industry to justify whip use. At the core of the debate is the question—do horses experience pain when being whipped? The study used microscopic studies of skin from 10 deceased humans and 20 euthanased horses to explore any differences between the species in their skin structure and nerve supply. The results revealed no significant difference between humans and horses in either the concentration of nerve endings in the outer pain-detecting layer of skin (epidermis) or in the thickness of this layer. In horses, this layer was deeper on the right than on the left. The collagen layer (dermis) of skin which is not involved in pain detection was significantly thinner in humans than in horses. These findings show that, although horse skin is thicker overall than human skin, the part of the skin that is thicker does not insulate them from pain that is generated during a whip strike, and that humans and horses have the equivalent basic anatomic structures to detect pain in the skin.

Abstract: The current project aims to build on knowledge of the nociceptive capability of equine skin to detect superficial acute pain, particularly in comparison to human skin. Post-mortem samples of gluteal skin were taken from men ($n = 5$) and women ($n = 5$), thoroughbreds and thoroughbred types (mares, $n = 11$; geldings, $n = 9$). Only sections that contained epidermis and dermis through to the hypodermis were analysed. Epidermal depth, dermal depth and epidermal nerve counts were conducted by a veterinary pathologist. The results revealed no significant difference between the epidermal nerve counts of humans and horses ($t = 0.051$, $p = 0.960$). There were no significant differences between epidermal thickness of humans ($26.8 \mu\text{m}$) and horses ($31.6 \mu\text{m}$) for reference (left side) samples ($t = 0.117$, $p = 0.908$). The human dermis was significantly thinner than the horse dermis ($t = -2.946$, $p = 0.007$). Epidermal samples were thicker on the right than on the left, but only significantly so for horses ($t = 2.291$, $p = 0.023$), not for humans ($t = 0.694$, $p = 0.489$). The thicker collagenous dermis of horse skin may afford some resilience versus external mechanical trauma, though as this is below the pain-detecting nerve endings, it is not considered protective from external

cutaneous pain. The superficial pain-sensitive epidermal layer of horse skin is as richly innervated and is of equivalent thickness as human skin, demonstrating that humans and horses have the equivalent basic anatomic structures to detect cutaneous pain. This finding challenges assumptions about the physical capacity of horses to feel pain particularly in comparison to humans, and presents physical evidence to inform the discussion and debate regarding the ethics of whipping horses.

Keywords: innervation; dermis; epidermis; nerve cell counts; pain; whipping

1. Introduction

The use of whips in horse racing is increasingly being questioned on ethical, welfare [1–11], social sustainability [10], and legal grounds [8]. Racing industry proponents argue that “the whip is used for safety (of both rider and horse) or to encourage the horse to perform to its best when in contention”, and that horses in many jurisdictions are protected from pain by whip padding and rules that govern whip use [12]. Some industry commentators have asserted that racing horses are immune to any pain from whip strikes chiefly because they are adrenalinised [13]. Others point out that horses may be physically brutal with one another in social interactions or conflict [14] and have therefore evolved to be robust and stoic. At the core of the debate is a fundamental question—do horses experience pain when whipped?

It is broadly accepted in science and society that most animals experience pain when struck. This is reflected by current societal norms, ethics, and laws that prohibit the striking or hitting animals. However, this protection is not extended to certain animal species—these being almost exclusively large domestic species—including the horse. It is reasonable to question why the assumption exists, and crucially, what scientific evidence exists to demonstrate that horses do or do not feel pain when being whipped.

Assumptions that horses are insensitive to pain may be influenced by historic factors and colloquialisms. The term “thick-skinned”, to denote insensitivity, has been in the English lexicon for over 400 years [15]. In parallel, the scientific community previously taxonomically defined and grouped certain species by having thick skin. The term “pachyderm” (from the Greek “pachys”, meaning “thick” and “derma”, meaning “skin”) long grouped elephants, hippopotamus, horses, pigs, and other large species together [16].

In recent decades, limited scientific data have become available that document the full skin thickness of horses, with it reportedly ranging between 1.2 to 7 mm. [17,18]. This is indeed considerably thicker than full thickness human skin, reported at 1.2 mm thick on average in multiple studies [19–21], with a range of 0.52 to 2.0 mm [21]. However, interpreting the skin thickness as a whole as an indicator of skin sensitivity fails to account for the complexity of the skin organ and, crucially, that detection of pain by mammalian skin overwhelmingly occurs in the very superficial layer of the skin (the epidermis), where the source of the painful stimulus (e.g., a strike or a heat source) comes into contact with these cells. Pain receptors of the skin are, in the vast majority, found in the epidermis, terminating in the mid to superficial epidermis [22,23]. These are fine, non-myelinated fibrils that detect damage to epidermal cells [22]. There may also be some dermal structures that have potential to act as nociceptors under some circumstances, such as thermal noxious stimulation [24] and following experimental selective ablation of epidermal nociceptors [25].

Reported data on horse epidermal thickness are sparse, though a mean epidermal thickness of 53 μm has been reported [26]. A recent study reported depth of equine epidermal from the thorax as 29 μm and from the limbs as 46 μm [27]. In comparison, four studies of human epidermal thickness found a mean epidermal depth of 51.2, 52.2, 53.0, and 91.8 μm , respectively [19–21,28]. What these data suggested is that where it counts, in terms of pain sensitivity, horse skin may be no more meaningfully

thick than human skin. However, because each prior study used variable methods to measure skin, the existing data across the two species could not be reliably compared.

Skin thickness aside, the capacity of skin to detect pain must also depend on the presence and density of the microscopic neural structures of the epidermis. Pain is a complex and primordial physiological function key to survival because it provides a powerful incentive to avoid tissue damage. The basic and absolute need for pain detection is reflected in the remarkable evolutionary conservation of nociception from metazoa to mammals [29]. There is no evidence of significant differences in the neural structures involved in nociception between mammalian species [30]. However, there are gaps in our detailed knowledge concerning presence and density of cutaneous nociceptive fibres in many animal species, including horses.

The capacity of the skin to detect pain normally is recognized to have a relationship with the number or density of nerve fibres in the epidermis, as demonstrated by rare diseases in humans that cause insensitivity to pain [31,32], and the use of intra-epidermal nerve counts to diagnose peripheral sensory neuropathies [23,33]. However, despite the long-standing debate surrounding capacity of horses to experience pain, there are no known reports in the scientific literature that describe and quantify intra-epidermal nerves in the horse.

This study aims to address these knowledge gaps to move us closer to an informed understanding of the capacity of the horse to experience cutaneous pain. This work has been conducted in part to inform the debate surrounding the use of whip strikes in the global horse racing industry, a debate which may become integral to the sustainability of the industry as it moves into the future.

The current project aimed to build on our knowledge of the nociceptive structures of equine skin, particularly in comparison to human skin. The project was designed to test three hypotheses derived from anecdotal approaches to the ability of horses to experience acute superficial pain. First, that horses have thicker epidermal skin layers than humans. Second, that horses have thicker dermal skin layers than humans. Third, that horses have fewer cutaneous nociceptive neurological structures than humans. The current study focused on Thoroughbred horses and horses of Thoroughbred type because of the relevance of the Thoroughbred to racing.

2. Materials and Methods

2.1. Ethics Approval

This work was approved by Macquarie University Human Anatomy Governance Committee (project number 2019-4). Animal Ethics Committee approval was not required for the use of tissues retrieved post-mortem.

2.2. Horse Skin Acquisition

A team of three personnel (one team leader, O.J., and two graduate students) attended an export abattoir to collect the equine tissues for this project. They identified Thoroughbreds and Thoroughbred types ($n = 20$) that were to be processed in a batch. No history was available for the horses. Targeted horses were sexed (mares, $n = 11$; geldings, $n = 9$) and marked with adhesive stickers. After euthanasia, their age was estimated from their dentition and recorded (see Table 1). Skin samples were removed using a scalpel from both the left and right gluteal region and added to container of paraformaldehyde phosphate buffer solution, labelled with the identify code of the horse. They were stored for a minimum of 30 days at room temperature prior to trimming.

Table 1. The distribution age ranges of men ($n = 5$), women ($n = 5$), mares ($n = 11$), and geldings ($n = 9$), from which six sections were taken.

Quartile	Horse Age Range	Number of Horse Sections	Human Age Range	Number of Human Sections
1	3–5	24	52–61	12
2	8–10	42	67–77	18
3	11–15	30	83–87	18
4	16–25	30	92–94	12

2.3. Human Skin Acquisition

Human skin was sourced from the Surgical Skills and Anatomy Centre (SSAC), Faculty of Medicine Health and Health Sciences, Macquarie University, NSW, Australia. Samples were acquired from ten fresh frozen human cadavers (men, $n = 5$; women, $n = 5$) and the age of the cadavers recorded (see Table 1). Skin samples were removed from both the left and right gluteal region, and added to a container of paraformaldehyde phosphate buffer solution, labelled with the identify code of the cadaver. They were stored for a minimum of 30 days at room temperature prior to trimming.

While every attempt was made to obtain three samples from each side of each subject, in some cases this was not possible. Missing data were as follows: nerve count data from horse sample #126, both sides (age quartile 1); nerve count, epidermal and dermal data from human sample #44,7 right side (age quartile 3); and nerve count data from human sample #453, both sides (age quartile 3). The problem of missing data was addressed statistically by use of a mixed model with a random effect structure, rather than the solely fixed effect model that had been planned. Mixed models are a method considered appropriate for unbalanced designs and for repeated measures such as was encountered in this data-set.

2.4. Histology Processing and Staining

All samples were submitted to a National Association of Testing Authorities (NATA) accredited histology laboratory for sample trimming and slide preparation. Skin from both horses and humans was trimmed into full thickness sections (epidermis to hypodermis inclusive) and placed in cassettes. Samples were embedded in paraffin wax, sectioned at 16 μm and stained with hematoxylin and eosin (HE) using established histological techniques. Slides were then cover-slipped using the adhesive dibutylphthalate polystyrene xylene.

2.5. Photographic Images

Photographic images of the horse skin sections stained with hematoxylin and eosin were taken on a BX-51 microscope, using a Jenoptik Gryphax Kapella camera (Jenoptik Group, Jena, Germany). A full thickness (epidermis to hypodermis) image was taken in the centre of each skin section (three on each slide). Images were taken using the panoramic function in the Jenoptik software (Jenoptik Group, Jena, Germany). Each image was 1100 pixels in width, and each pixel represented 1.05887 μm in real distance. Photographic images of the human skin sections stained with hematoxylin and eosin were taken on a CX43 microscope (Olympus, Shinjuku-ku, Tokyo, Japan), using an Olympus EP50 camera (Olympus, Shinjuku-ku, Tokyo, Japan). A full thickness (epidermis to hypodermis) single image or two sequential images were taken in the centre of each skin section (three on each slide), using the EPview software (Olympus, Shinjuku-ku, Tokyo, Japan). Each image was 1100 pixels in width, and each pixel represented 1.18181 μm in real distance. All images were saved as JPEG files, and in total 6 photographs were taken of skin from each horse or human; three from each side of the body. An image of the epidermis and superficial dermis was taken in three sequential regions of the skin section, excluding areas of stain precipitation or tissue folds. Each image was 2080 pixels in width and each pixel was 0.58140 μm in real distance. All images were saved as JPEG files and, in total, six photographs were taken of skin from horse or human; three from each side of the body.

2.6. Analysis of H&E Sections

All images were analysed by a specialist veterinary pathologist using Motic Images Plus software (Motic, Kowloon, Hong Kong). Only sections that contained epidermis and dermis through to the hypodermis were analysed. One human sample that did not contain epidermis despite rotation and re-embedding of the tissue and was excluded from analysis. The width of each photographic image was confirmed as 1100 pixels using PixelZoomer software (Matthias Schütz; www.pixelzoomer.com) and each pixel represented 2.9 μm in the photographic software. The image was orientated with the epidermis parallel to the short axis of the image and the area of the epidermis and dermis was measured using the Motic Images Plus freehand tool. In skin samples with invaginations of hair follicles (horse skin), the natural contour of the epidermis was followed across the ostia. In samples with anastomosing rete ridges (human skin), the natural contour of the epidermis was followed. The average depth of the epidermis and dermis was then calculated in microns by dividing the area by the width of the image and corrected for the number of microns per pixel.

2.7. Immunohistochemistry Protocol

Paraffin embedded blocks were submitted to a diagnostic histology laboratory for PGP9.5 immunohistochemistry. Three micrometre sections were cut from each block, and three sections were placed on each slide. Immunohistochemical staining PGP9.5 was performed using the Leica Bond III automated staining platform (Leica Biosystems, Melbourne, VIC, Australia). Heat-mediated antigen retrieval (100 °C) was used at pH 9 for 30 min. The primary antibody (Anti-PGP9.5, Polyclonal Rabbit) was incubated for 30 min at ambient temperature. Bond Polymer Refine Red Detection (DS9390) was used with the standard Leica protocol.

2.8. Analysis of IHC Sections

The project used standardised and recognized methodology for quantifying intra-epidermal and dermal innervation, as used by the European Federation of Neurological Societies (EFNS) in the assessment of peripheral neuropathies [33]. Morphometric methods were used to quantify the density of neural structures in the epidermis as a count of intra-epidermal nerve fibres per mm of epidermis. The EFNS guidelines [33] were followed to count each nerve fibre crossing the basement membrane at the dermal–epidermal junction as a single unit. Nerve fibres branching in the epidermis were counted as one unit, nerves that split below the basement membrane were counted as two units, nerve fibres that failed to cross the basement membrane or were present in the epidermis but do not cross the basement membrane were not counted. Each fibre to be counted was indicated with a marker, with a total count being recorded for each examined section of skin.

2.9. Statistical Analysis

Epidermal depth (μm), dermal depth (μm) and nerve count (epidermal BM/mm), were modelled using a linear mixed effect model, with log transformation of epidermal depth and nerve count because of improved diagnostic plotting following such transformation. The model included the interaction between Species (Horse or Human) and Sex (Female or Male), as well as the age of the subject (the age was split into species quartiles due to the mean and variance differences between species) and the side (Right or Left) from which the sample was taken, both nested within species. Additional to these fixed effects, a fixed section number effect (First, Second and Third) was included to correct for any biases caused by the viewing order of samples and a random individual effect to account for individual variation). Models were fit using R Statistical software [34], making use of the “lme4” package [35]. Statistical significance was accepted at $p < 0.05$.

3. Results

3.1. Overview

Histological examination of horse and human skin revealed similar anatomical architecture with clear demarcation between the epidermis, dermis and hypodermis and shared fundamental histological features. The epidermis of stratified squamous epithelium contained the stratum basale embedded with variable numbers of pigmented cells on a basement membrane, stratum granulosum, stratum spinosum and stratum corneum. The superficial papillary dermis extended from the epidermal basement membrane and consisted of loosely separated collagen bundles that surrounded primary hair follicles and associated adnexal glandular tissue. The deeper reticular dermis extended from the follicular–adnexal units and consisted of more tightly packed collagen bundles. The hypodermis contained a predominance of adipose tissue with loose strands of collagen. Observation differences between the horse and human skin included greater density of follicular-adnexal units in the horse. While both equine and human epidermis form distinct rete ridges at the dermo-epidermal junction, these tended to be thinner and deeper with occasional anastomosis noted in human skin (see Figure 1).

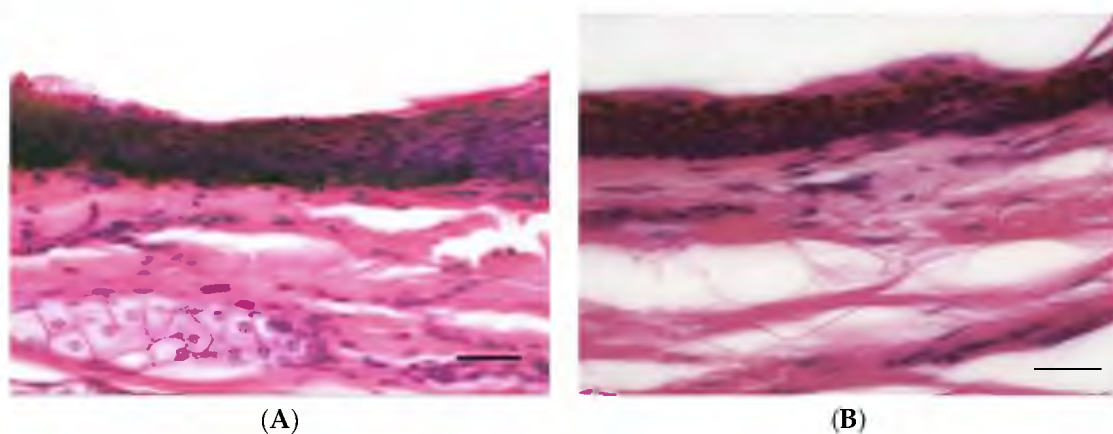


Figure 1. Representative histologic images of horse (A) and human (B) epidermis and superficial dermis of gluteal skin illustrating comparable epidermal thickness (Haematoxylin and Eosin, 400×, 16 µm sections. Bar = 20 µm).

3.2. Epidermal Thickness

Plots of the data showed some signs of a right skew, so introduction of a logarithmic transformation was decided upon. The logarithmic boxplots are presented for reference purposes (see Figure 2).

The marginal R^2 and conditional R^2 for the epidermal thickness model were 0.216 and 0.585, respectively, indicating that both fixed effects (marginal R^2) and fixed and random effects considered together (conditional R^2) account for substantial proportions of the variance in epidermal depth. The individual random effect for the epidermis model accounted for 47% of the variance. The fixed effect coefficients calculated for this model appear in Table 2.

No significant differences were found between humans and horses for left sides samples ($t = 0.117$, $p = 0.908$, see Figure 3). Humans had skin 0.185 units thinner on the log scale which corresponds to approximately 16.9% thinner.

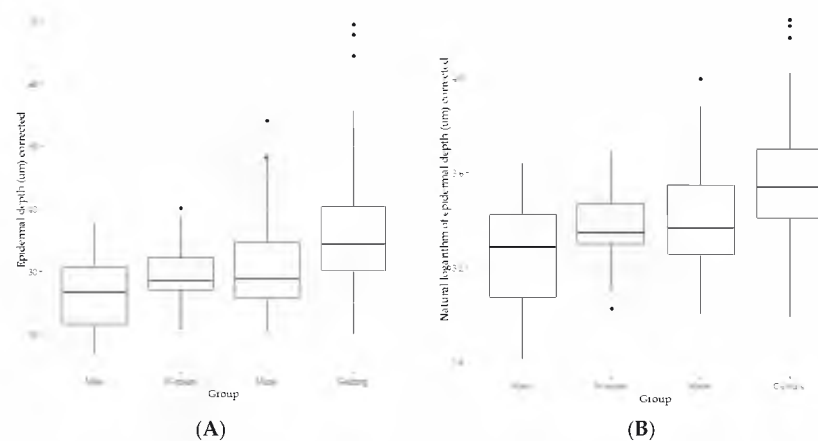


Figure 2. The box-and-whisker plots for the epidermal depth (A) and natural logarithm of epidermal depth (B) of skin from men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$).

Table 2. The fixed effect coefficients calculated for a linear mixed model exploring the epidermis of men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$). Significant findings appear in bold.

	Coefficient	Std. Error	d.f.	<i>t</i> Value	<i>p</i> Value
(Intercept)	3.499	0.127	28.898	27.478	$<2 \times 10^{-16}$
SpeciesHuman	−0.185	0.218	25.565	−0.849	0.404
SexMale	0.132	0.083	24.748	1.577	0.128
Section	0.005	0.016	148.977	0.346	0.730
SpeciesHuman:SexMale	−0.228	0.145	25.346	−1.572	0.128
SpeciesHorse:Age_quantile	−0.049	0.039	24.748	−1.238	0.227
SpeciesHuman:Age_quantile	0.004	0.056	24.790	0.076	0.940
SpeciesHorse:SideRight	0.071	0.031	148.977	2.291	0.023
SpeciesHuman:SideRight	0.032	0.047	152.012	0.694	0.489

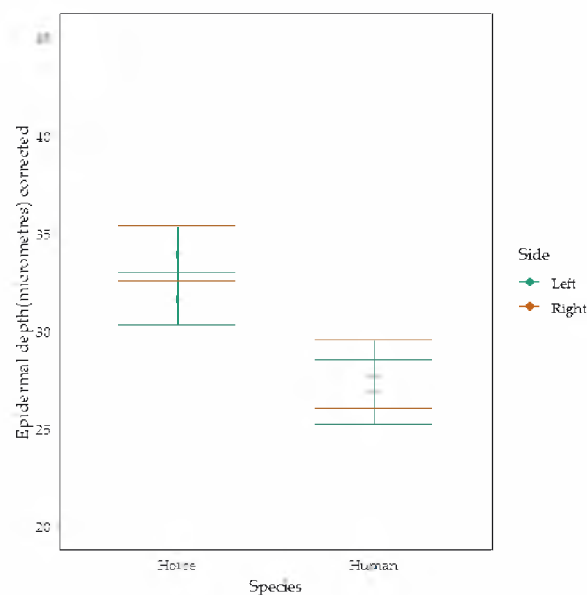


Figure 3. The box-and-whisker plots for the corrected epidermal depth of skin from men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$). Coefficients and error bars are shown on the original measurement scale for ease of interpretation. This figure illustrates the significant interaction effect found between the side from which the sample was taken and the species from which the sample was taken.

3.3. Dermal Thickness

There was some suggestion of negative skew (see Figure 4), but the diagnostic residual plots were adequate.

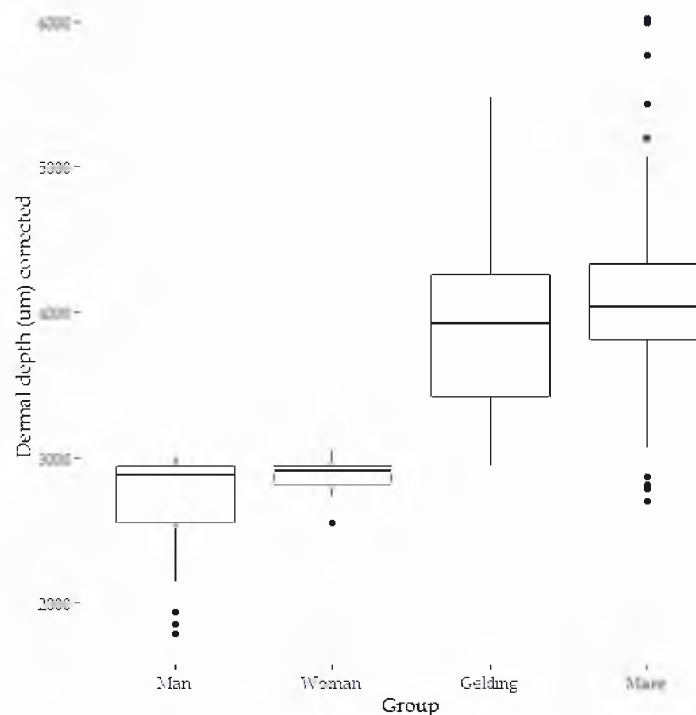


Figure 4. The box-and-whisker plots for the dermal depth of skin from men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$).

The marginal R^2 and conditional R^2 for the dermal thickness model were 0.548 and 0.867, respectively, indicating that both fixed effects (marginal R^2) and fixed and random effects considered together (conditional R^2) account for substantial proportions of the variance in dermal depth. The individual random effect for the dermis model accounted for 71% of the variance. The fixed effect coefficients calculated for this model appear in Table 3.

Table 3. The coefficients calculated for a linear mixed model exploring the dermis of men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$). Significant findings appear in bold.

	Estimate	Std. Error	d.f.	<i>t</i> Value	<i>p</i> Value
(Intercept)	4358.564	343.092	26.694	12.704	0.000
SpeciesHuman	−1759.220	597.193	25.335	−2.946	0.007
SexMale	−193.894	229.847	24.993	−0.844	0.407
Section	−10.844	27.747	149.095	−0.391	0.696
SpeciesHuman:SexMale	91.974	397.560	25.280	0.231	0.819
SpeciesHorse:Age_quantile	−5.897	108.129	24.993	−0.055	0.957
SpeciesHuman:Age_quantile	124.633	154.417	25.013	0.807	0.427
SpeciesHorse:SideRight	−428.025	54.606	149.095	−7.838	0.000
SpeciesHuman:SideRight	−113.599	83.199	150.535	−1.365	0.174

The human dermis was significantly thinner than the horse dermis ($t = -2.946$, $p = 0.007$, see Figure 5).

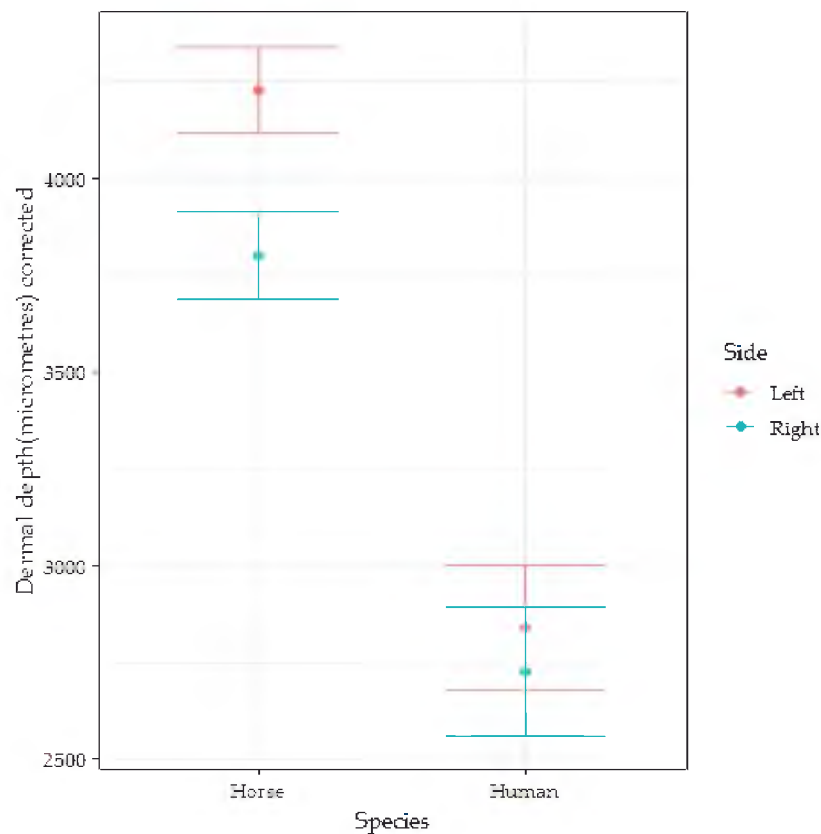


Figure 5. The box-and-whisker plots for the dermal depth of skin from men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$). Coefficients and error bars are shown on the original measurement scale for ease of interpretation. This figure illustrates the significant interaction effect found between the side from which the sample was taken and the species from which the sample was taken.

3.4. Epidermal Nerve Count

Typical examples of the results of the immunohistochemistry studies are shown in Figure 6. The distributions of nerve counts scores appear in Figure 7.

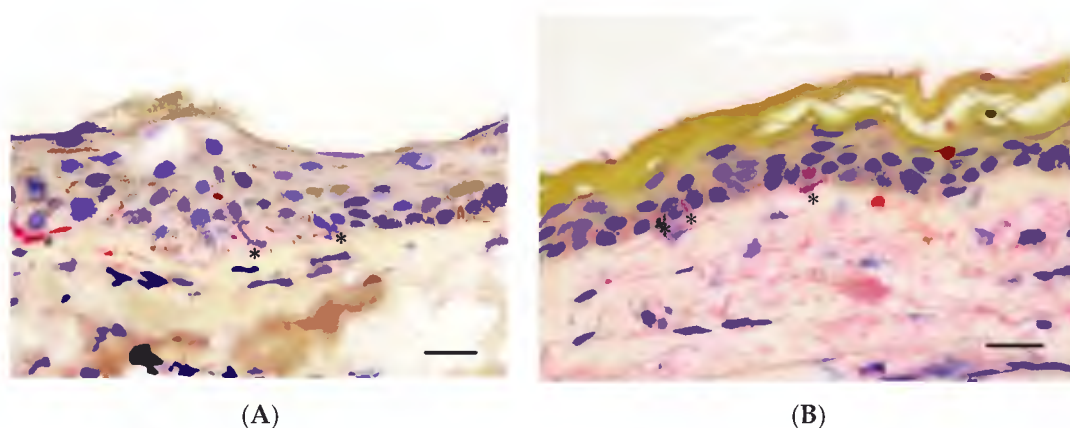


Figure 6. Representative skin sections stained with immunohistochemistry using anti-PGP9.5 antibodies from Horse (A) and Human (B) skin. Images include epidermis and superficial dermis. Nerve endings are selectively stained with a red dye (*). Sections illustrate the finding that epidermal nerve endings are found in equivalent density across horse and human skin (anti-PGP9.5 immunohistochemistry, 400× magnification. Bar = 20 μ m).

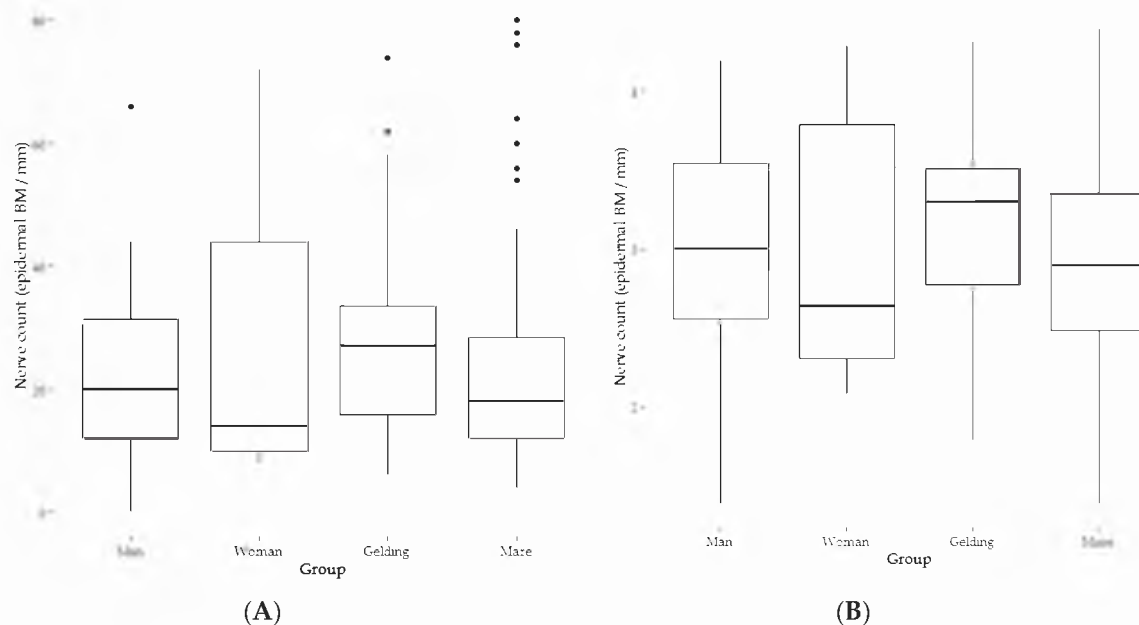


Figure 7. The box-and-whisker plots for the epidermal nerve count (A) and natural logarithm of epidermal depth (B) of skin from men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$).

Some concerning shapes on the QQ and Scale location plots were found for in the residuals of the linear mixed model of the untransformed data, but were ameliorated with log transformation, apparently due to the presence of true zeros and positive skew in the original data.

The marginal R² and conditional R² for the model (see Table 4) of the transformed nerve count data (see Figure 7, panel B) were 0.042 and 0.716 respectively, indicating that both fixed effects (marginal R²) were relatively unimportant for this model but random individual effect still accounted for substantial proportions of the variance in epidermal nerve count, in this case, 70% of the variance. The relative unimportance of the fixed effects, which include Species compared to the thickness of skin layers is interesting to note. The coefficients calculated for this model appear in Table 4.

Table 4. The coefficients calculated for a linear mixed model exploring the epidermal nerve count of men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$). Significant findings appear in bold.

	Estimate	Std. Error	d.f.	<i>t</i> Value	<i>p</i> Value
(Intercept)	2.727	0.468	24.627	5.829	0.000
SpeciesHuman	0.041	0.806	24.215	0.051	0.960
SexMale	0.238	0.312	23.887	0.764	0.453
Section2	0.081	0.076	142.990	1.072	0.286
Section3	0.080	0.076	142.990	1.057	0.292
SpeciesHuman:SexMale	−0.254	0.534	24.160	−0.476	0.638
SpeciesHorse:Age_quantile	0.049	0.150	23.887	0.329	0.745
SpeciesHuman:Age_quantile	0.063	0.206	23.907	0.303	0.765
SpeciesHorse:SideRight	0.150	0.075	142.990	1.993	0.048
SpeciesHuman:SideRight	−0.148	0.112	144.384	−1.331	0.185

There was no significant difference between human and horse nerve counts ($t = 0.051$, $p = 0.960$, see Figure 8).

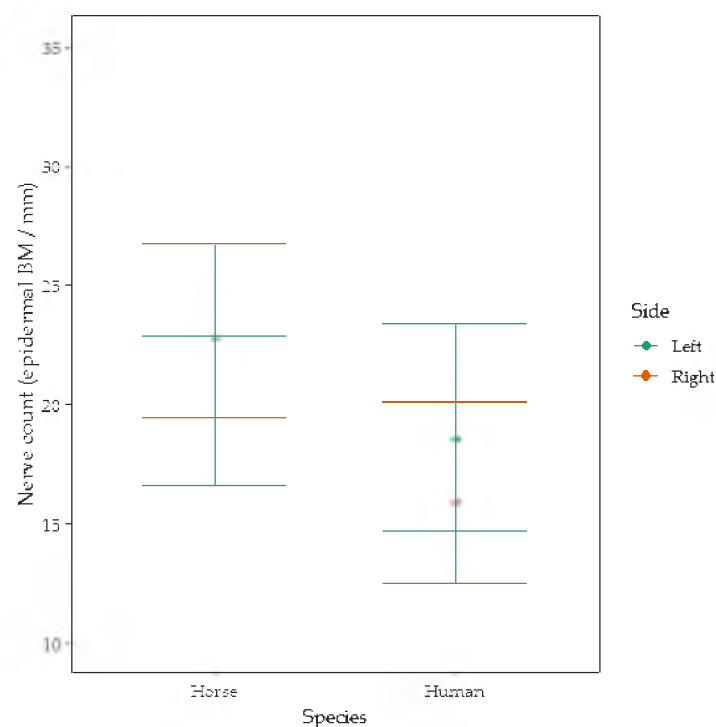


Figure 8. The box-and-whisker plots for the epidermal nerve count of men ($n = 5$), women ($n = 5$), mares ($n = 11$) and geldings ($n = 9$). Coefficients and error bars are shown on the original measurement scale for ease of interpretation. This figure illustrates the significant interaction effect found between the side from which the sample was taken and the species from which the sample was taken.

4. Discussion

The results revealed no significant differences between epidermal thickness of humans and horses for left-sided (reference) samples. This refutes our first hypothesis, that horses have thicker epidermal skin layers than humans. There was mild asymmetry of the thickness of the horse epidermis between left and right sides, and the right horse epidermis was therefore marginally thicker than right human epidermis. This is an unusual finding and is discussed below. As was expected, the horse dermis was significantly thicker than the human dermis, supporting our second hypothesis. The structural integrity of the relatively thick equine dermis may withstand forceful impacts better than human dermis. However, the facts of cutaneous innervation with respect to nociception demonstrate that dermal thickness cannot be a significant factor in skin sensitivity. There were no significant differences between the epidermal nerve counts of humans and horses, refuting the third hypothesis that horses have fewer dermal nociceptive neurological structures than humans.

Together, these findings indicate that horse skin is virtually indistinguishable from human skin with respect to the basic anatomical structures relevant to cutaneous pain detection. These observations must refresh old assumptions made about the capacity of the “thick-skinned” horse to experience pain in comparison to humans.

It is recognized that pain is an enormously complex process, with huge amount of modulation of nociceptive signalling between noxious stimulation at the skin and the perception of pain in the higher centres of the central nervous. The current study does not attempt to assume, based on these findings, that the end-experience of pain in the horse is the same as in humans, as such a comparison is currently outside the capability of science, even when comparing the experience of pain between two humans. However, this does mean that broad similarity between species permits valid comparisons about pain perception, even in the absence of absolute equivalence of skin structures.

An observational study of horses racing in Australia [4] found 83% of whip strikes caused indentations of the skin of the horses whipped, and comparative studies in mice and humans showed

such deformation is likely to be detected by cutaneous nociceptors [36], as did a recent study in horses [37]. Fundamentally, if an anti-nociceptive/analgesic state arises in all racing horses, it begs the question that if the whip has lost its salience, then why use it at all? Recent evidence indicates that certain distinct stress-related, affective states are characterised by enhanced, not reduced pain perception [38–41].

Repeated whipping is common in racing even though the IFHA forbids “using the whip with excessive frequency” [42]. The accumulated damage from successive strikes is likely to create more pain and inflammation. This assumption is based on the results of a feline study [43] in that repeated application reduced the thresholds for nociceptor activation and enhanced the duration of their responses. In Australia, racing thoroughbreds may be struck no more than five times prior to the final 100 m but after this point they can be struck at the jockey’s discretion [44]. This can equate to a strike per stride and effectively this means that 18 strikes per race are within the rules [13].

Forceful impact to equine skin may occur outside racing and other forms of equestrian activity. It is accepted that horses can cause severe injuries to one another, for example in disputes over focal resources such as food [14]. However, an important distinction to make in this context is that they are not being exposed to harm or injury by commission of an act by a human that is of no benefit to the horse.

In the current study, the horse epidermis was deeper on the right than on the left- and right-sided horse epidermis was thicker than human epidermis (which showed a non-significant trend towards similar left–right asymmetry). Bilateral asymmetry of epidermal thickness is a highly unexpected finding. The authors are not aware of reported asymmetry for measurements of normal skin thickness (epidermis or dermis) in any human or mammalian study. Localised or regional thickening of the epidermis may occur in pathologic states, and is known as epidermal hyperplasia or acanthosis. Epidermal thickening occurs in response to chronic insult or injury to the epidermis [45]. Thinning of the epidermis can occur in pathological states. However, these are generally restricted to cutaneous endocrinopathies and the epidermal thinning in these conditions is bilaterally symmetrical. Other pathological or physiological causes cannot be entirely excluded. There is evidence that horses tend to use their left eye when approaching potential threats [46], which could arguably eventuate in a bias for left-sided injury. So, one might have predicted that the skin on the left side of horses needs to be stronger than that on the right side. An investigation into epidermal asymmetry in horse skin would be a worthwhile future study.

The role of pain in horse sports is part of the growing debate about what constitutes ethical equitation [7,47]. In a flight animal, such as the horse, being unable to resolve aversive cutaneous stimulation causes distress. Horses have evolved to run away from such stimuli since the most likely natural cause of such stimulation is contact from a predator. Repeated strikes of the whip in horses that are fatigued as they end a race [3] are likely to be distressing and cause suffering. The horses’ loss of agency is described in the literature as helplessness and repeated, inescapable, treatment of this sort is thought to lead to learned helplessness [48].

The concept of ethical equitation [1] advocates a three-step process for stakeholders who seek to retain the social license to operate [13]. It demands that we identify the causes of distress in the horses we ride, that we mitigate these stressors as much as possible and we justify the retention of those that cannot be mitigated. The current findings suggest the ethical future for racing is one in which whips are carried but not used for so-called encouragement. Fortunately, this model is already well established in the UK where apprentice jockeys compete in hands-and-heels series [49].

A minor limitation of the current study is that human cadavers were fresh frozen, while the equine tissues were processed immediately after euthanasia. It is possible, but highly unlikely, that this contributed to the similarity of the tissues. The imbalance between the numbers of human and equine samples was caused by the 2020 national lockdown in Australia that interrupted access to specimens from human anatomy classes. A further minor limitation is that we were unable to gather data on any potential structural difference in the hairs of horses and humans. It appears unlikely that hairs afford

meaningful protection from the impacts of whips, given that whips cause cavitation waves through the skin and underlying tissues [50]. Studies of anaesthetized horses may assist in this domain and might also be helpful in revealing the thermographic responses of horse skin to whipping. Future adjunctive research should include histopathological examination of bilateral skin and subcutaneous tissues from horses which have died within seven days of a racing event. This could reveal any evidence of inflammation and repair at the site of recent whip strikes.

5. Conclusions

This primary aim of this project was to improve our understanding of the neuroanatomy of horse skin with respect to cutaneous pain sensation. The project achieved this aim through quantitative methods, using research material that can be openly accessed by interested parties. The results revealed no significant difference between the epidermal nerve counts of humans and horses. There were no significant differences between epidermal thickness of humans and horses for left side samples. The human dermis was significantly thinner than the horse dermis. The horse epidermis was deeper on the right than the left. These findings indicate that the superficial pain-sensitive epidermal layer of horse skin is as richly innervated and is of equivalent thickness as human skin, demonstrating that humans and horses have the equivalent key anatomical structures to detect cutaneous pain.

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Behavior Problems in Mares: Ovaries Aren't Always to Blame

February 2, 2018 • **Posted by** Alexandra Beckstett

Removing the ovaries won't fix other issues, from static shock to bladder adhesions, that can make mares behave badly.

Topics: AAEP Convention, AAEP Convention 2017, Article, Behavior, Behavior & Handling, Breeding and Reproduction, Breeding Basics, Equine Care Professions, Horse Care, Mare Care, Mare Care and Problems, Reproductive System, Vet and Professional, Vet Convention Reports, Veterinary Practice

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The veterinarians at the University of Pennsylvania's New Bolton Center regularly evaluate mares for suspected ovary-related behavior issues. In most cases, however, they find the root cause is something else entirely.



More often than not, with cases referred for an ovariectomy (removal of the ovaries) the root cause of discomfort has nothing to do with the ovaries, McDonnell said. | Photo: iStock

Sue McDonnell, PhD, CAAB, adjunct professor of reproductive behavior and founding head of the University's Equine Behavior Program, has been evaluating these so-called problem mares for decades. At the 2017 American Association of Equine Practitioners convention, held Nov. 17-21 in San Antonio, Texas, she described how the team at New Bolton Center, in Kennett Square, evaluates them and shared some case examples.

"Diagnosing the root causes (for behavior problems) is important for

welfare, safety, and client satisfaction," she said.

When evaluating a mare whose owner complains of "marish" or "hormonal" behavior, McDonnell said she first obtains and views a 24-hour video sample of the horse in its stall. During this period, she will watch for behavior patterns suggesting the mare is in discomfort, such as tail- or hip-rubbing, udder-nuzzling, kicking at walls, etc.

She might also present the mare with social "challenges" such as feces from other mares or stallions, teasing, or mares in estrus as well as diestrus (the period between heat cycles). The mare's behavior often suggests the type and location of discomfort, giving clinicians some direction for diagnostic examinations, such as reproductive and endocrine exams, lameness evaluation, diagnostic imaging, neurologic exam, gastroscopy, or even dental.

"More often than not, with cases referred for an ovariectomy (removal of the ovaries) the root cause of discomfort has nothing to do with the ovaries," said McDonnell. Examples of actual causes of problem behaviors she said were initially attributed to ovarian function include gastric ulcers, impaction colic, enteroliths, uterine adhesions, vaginitis (vaginal inflammation), mastitis (mammary gland inflammation), strangulating abdominal lipomas (fatty tumors), uroliths (bladder stones), sleep deprivation, headshaking syndrome, and musculoskeletal pain.

McDonnell then described a few cases that have come to the New Bolton Center clinic as ovary issues that the veterinarians ultimately diagnosed as something entirely different.

Case 1

The owner of a 7-year-old Thoroughbred hunter/jumper said the mare was refusing to canter, balking at jumps, exhibiting stallionlike behavior, being pushy, and reacting explosively during trailering. Upon arriving at the clinic, the mare panicked and exploded out of the stocks.

While observing her behavior, McDonnell noted that this mare would have kicking episodes, pull her hind limbs up to her abdomen, perform deep abdominal stretches, paw, stamp, gaze at her abdomen, display male-type behavior such as the flehmen response, nip at her chest, and stop eating and resting suddenly.

"Sudden interruption of eating and resting is a really good indicator of discomfort," she noted.

After various diagnostics, the veterinarians discovered an adhesion on her bladder to the surrounding organs. They later also diagnosed and removed a granulosa cell tumor from her ovary, which could have been to blame for the stallionlike behaviors. While her physical discomfort disappeared after veterinarians treated these issues, McDonnell said she remained nervous in confined spaces.

Case 2

A 16-year-old warmblood mare who, after having been an agreeable family horse her entire life, suddenly became aggressive and untouchable behind her shoulder.

Video evaluation of her behavior revealed around-the-clock signs consistent with abdominal discomfort (e.g., tail-slapping, weight shifting, looking at her sides, interrupted eating and resting, frequent deep abdominal stretches). Eventually, veterinarians diagnosed the cause of her discomfort as gastric impaction. At the time, it was the largest the clinicians had ever seen, said McDonnell.

Case 3

A 7-year-old Thoroughbred mare who, for the past two years, beginning in late October, would become frantic before morning turnout. Her owner reported that she would weave, chew wood, resist leaving the barn, become difficult to release, run to the corner of her pasture, and tremble. She was also nervous and nippy during grooming and tacking. This would last through late spring, when the behavior issues disappeared until the following October.

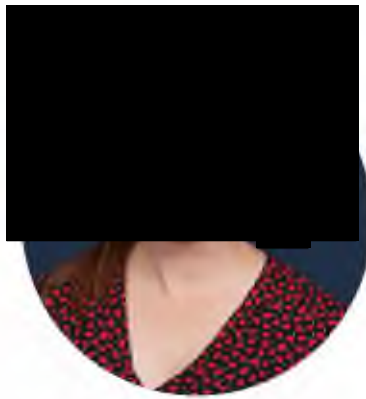
The veterinarians considered performing an ovariectomy. But after a careful behavior evaluation, they determined the root cause of her behavior was static electricity. She was extremely static-electricity-sensitive, which coincided with the months of the year she wore a blanket.

These cases are just a few classic examples of the many mares that get referred to the New Bolton Center for ovariectomies, said McDonnell. “Two-thirds to three-quarters of the cases that come in for an ovariectomy, an ovariectomy would not have alleviated the discomfort,” she said. “There were other, often multiple, root causes.

“Accurate diagnosis is important to successful resolution of the problem, with significant implications for horse welfare and client satisfaction,” she added.

Share





Alexandra Beckstett

Alexandra Beckstett, a native of Houston, Texas, is a lifelong horse owner who has shown successfully on the national hunter/jumper circuit and dabbled in hunter breeding. After graduating from Duke University, she joined Blood-Horse Publications as assistant editor of its book division, Eclipse Press, before joining The Horse. She was the managing editor of The Horse for nearly 14 years and is now editorial director of EquiManagement and My New Horse, sister publications of The Horse.

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Don't Get Shocked

Horse Life

- 
- – October 10, 2023

Make sure your barn's electrical system is in good condition to avoid injuries or fires.

Regular inspection of your horse's water buckets, troughs, and automatic waterers is an important barn management task. But so is examination of your barn's electrical system. These horse owners learned the importance of electrical safety the hard way. Thankfully, no horses were seriously injured, but from these experiences we can learn ways to keep our barn environments safer.

Jumping and Jittering

Sharon Wellmann is an APHA and AQHA Professional Horseman with a training barn in Conroe, Texas. Eight years ago, she noticed that her horses were behaving strangely when her assistant was walking them out of the facility's main barn into the arena.

"The horses were jumping out of the door," Wellmann says. "They would get to the door, then leap into the air."

Wellmann had been out of town, so she figured they were just acting up. But then, a horse not wearing metal shoes walked out of the barn and had no reaction.

"We brought another horse out after that with shoes on their feet, and they refused to walk out that door," Wellmann says. "Horses with shoes on would hit the ground, get all four feet out, and leap away from you. We knew something was wrong."

By chance, Wellmann's horseshoer was there, so she talked to him about the issue. He had an idea.

Finding the Problem

"We got a voltage meter, inserted it into the ground, and it was registering electrical current," Wellmann says. "Apparently we had a short in a wire, and it was shocking the horses when they were walking over top of it."

The immediate problem was getting the horses out of the barn that day. So Wellmann pulled out rubber stall mats and completely covered the path from the barn to the arena, and that prevented the horses from being shocked.

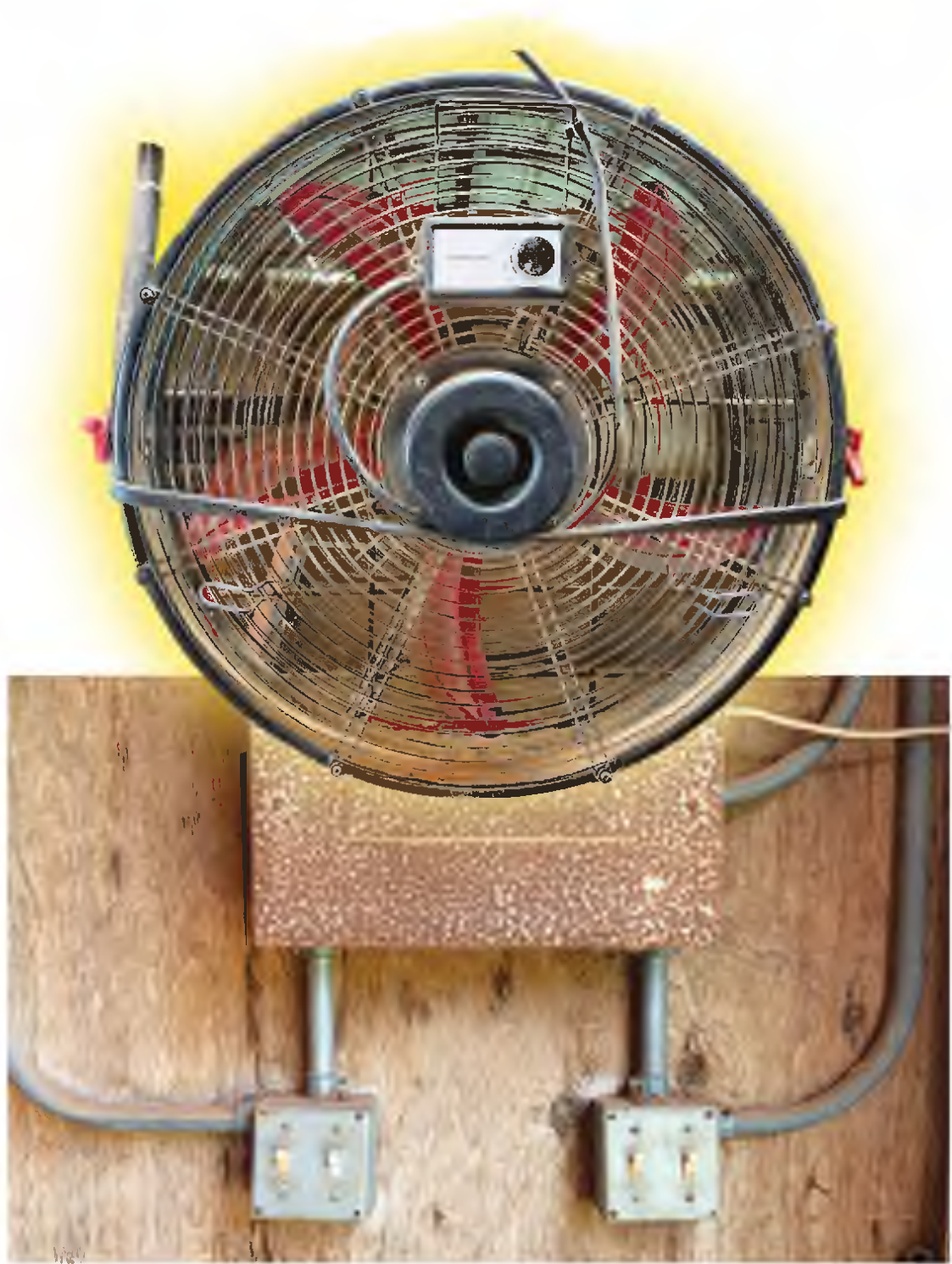
The barn had been built in 1979, and Wellmann worked there before she and her husband, Charles, purchased it 30 years ago. They had replaced or upgraded nearly everything during that time.

"As the years have progressed, we replaced everything correctly with safety in mind," Wellmann says.

Further investigation showed that a nick to the wire somewhere along the line had caused a short. The Wellmanns called an electrician service, which redid all the barn's wiring, and put everything in conduit, protected, and underground.

"We replaced everything from the meter pole all the way to the barn," Wellmann says. "We have two barns, and the other barn didn't have a problem, but we dug everything up and made the changes with prevention in mind."

Thankfully, the electric current wasn't too strong to where it affected the horses' health—Wellmann says it was similar to a cattle prod.





TOP: An enclosed fan offers ventilation with a reduced risk of motor or blades becoming damaged. MIDDLE: The left side and right side of the barn are wired separately at Wellmann's facility, which allows them to dedicate the left side for light switches and the right side for fans. BOTTOM: This box has switches with a reset button, which prevents the fuse box from blowing up should an appliance get too hot. Photos courtesy of Sharon Wellmann

Something in the Water

Dr. Sue Hunter is a small-animal veterinarian in Las Vegas, Nevada. Five years ago, she noticed some horses at the barn where she boarded her own horses were acting strangely.

"One horse was doing something with her face—they scoped her and spent a ton of money on tests trying to figure it out," Dr. Hunter says. "Another horse kept ripping the automatic waterer out of his stall."

When she observed her own horse behaving oddly, she became even more concerned.

"One day, I put my horse back in his stall, and he walked over to the water, went to take a drink, and jumped back," Dr. Hunter says. "I talked to the woman who owns the barn, and said, 'It sounds crazy, but he acted like he got shocked by the water.' We watched him, and he did go drink the water but was very hesitant to do it."

After she saw her horse react this way more than once, she asked Dr. Wyatt Winchell, who is an equine surgeon, to look into the situation. He confirmed that the behavior sounded like something wasn't right. Wyatt came out to the barn with a voltage meter and measured the electricity in the water in all the waterers in the barn.

"I put the voltmeter in an [automatic] water trough, and there was a low-level current going through," Dr. Winchell says. "It wasn't perceptible, but it was enough to get a reading on the voltmeter."

The Culprit

He walked out to the barn's pump house, and there was a junction box that ran the pump.

"You could actually see electricity arcing from the junction box, which was sitting against the water collection tank that fed the barn," Dr. Winchell says. "The current was getting transported from the water collection tank through the water into the barn, into those automatic waterers, and creating enough voltage, not enough to hurt the horses, but enough that the horses didn't want to drink out of those waterers."

The next day an electrician came out and repaired the arcing current, and the horses went back to drinking their water as normal. What surprised Dr. Winchell most was the electrified water had passed through PVC pipes to the waterers.

"The property used well water, and I think there's enough mineral content in the water that it carried a low-level current right into the automatic waterers," Dr. Winchell said.

Both Dr. Hunter and Dr. Winchell are glad the problem was discovered before it seriously harmed the horses.

"The biggest risks are always dehydration. Horses were very reluctant to drink out of those buckets, which can be a problem depending on the time of year, or if someone wasn't watching closely," Dr. Winchell said. "In the most severe cases, you can have electrical shock and death."





TOP: Check your automatic waterers regularly to make sure there are no shorts or other electrical issues. Photo by Abigail Boatwright

MIDDLE: An enclosed LED light is a safer alternative to a clamp light with an exposed bulb and cord. Picture courtesy of Sharon Wellmann

BOTTOM: The left-side plugs are for lights, the right side is for fans. Photo courtesy of Sharon Wellmann

Barn Safety Tips:

Don't take shortcuts.

Take the time and money to install and maintain electrical components the right way, rather than going for time- or cost-saving methods, Wellmann says.

"If you do it correctly, with prevention the first time, you hopefully won't have to fix anything the second time," Wellmann says. "Take the time to run wiring through conduit. Make sure your breaker boxes are capable of handling the amount of electricity you use."

Check for grounding.

Dr. Winchell recommends making sure all your underground wires are protected. And that your watering systems are grounded—and checking on them on a regular basis. He also says in the winter, electric waterers or buckets with heaters in the bottom can create a small electric shock, so check those frequently.

Plan for barn tasks.

The Wellmanns now have dedicated plugs for fans and lights. They've installed plugs above the stalls where the conduit and wires are, among other locations. And they planned the plugs and lights to make sense for their barn routines.

"We have a four-plug box with four plugs," Wellmann says. "One side has two plugs for the lights, the other side has two plugs for fans. And then we have switches for each side. This is so we can turn the fans on without the lights, and vice versa."

Be cautious of clamp lamps.

Think twice before adding heat lamps or lights attached with a clamp, Wellmann says.

"I've done clamp lights, way up high. But, if you have a horse that pulls on the lamp shield or cord and pulls it down while it's still on—that is so dangerous," Wellmann says. "The bulb can break, the cord wiring can short out—I don't recommend it."

Instead, consider installing rod LED lights. They use less electricity, but easily illuminate your barn.

"They're super bright, but it's not a bulb—it's completely covered, so you don't get cobwebs inside," Wellmann says. "And they give out plenty of light to keep your horse's coat short in the wintertime, or to keep your horse cycling."

Still, she recommends not using heat lamps, even when it's cold.

"In the super bad freeze a year ago, one of the other judges and trainers I know, had heat lamps on her horses in the barn, and the barn caught fire because of them," Wellmann says. "They lost the horses. it's not worth taking that chance. Put another blanket on your horses instead."

Reconsider box fans.

Overhead fans are the best option, but not feasible for many barns or boarders. But Wellmann has switched from box fans to heavy-duty, 3-speed, circular fans with enclosed motors.

"That helps keep the dust, dirt, and cobwebs out," Wellmann says.

Clear the cobwebs.

Dust and spiderwebs can become flammable around electrical elements. That's why Wellmann recommends clearing them away using an air compressor with a wand and nozzle attachment—or a broom—or both.

"Before we plug in our fans for the year, we go through with a broom or a brush. We clean all the sockets, and everything around the electrical boxes," Wellmann says. "We try to keep it clean so we don't have a fire hazard. And if you have a fly spray system in your barn, it helps take care of spiders also, so you don't have spiderwebs as an issue."

An air compressor easily blasts away dust and cobwebs around plugs out of reach, and fan blades, Wellmann says.

Include surge protectors.

Wellmann's husband added surge protectors to safely handle potential surges in electricity.

"That way, if the plugs get overwhelmed—if we have a fan and the horseshoe grinder and another appliance going at the same time, it'll pop and go off at the plug, instead of continuing to run hot, or pop the major breaker," Wellmann says.

Add motion sensor lights.

Wellmann says the electrical company that rewired her barn was able to install LED motion sensor security lights in strategic locations on her property.

"They don't add much to your electric bill. And they're nice to be able to see if a horse got out, or if something is going on around the barn," Wellmann says.

[\[Check Out These 5 Things Your Vet Wants You to Know\]](#)

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Fall 23

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– KEEP READING –



Military horses run loose again in central London

Figure caption,

Watch: Horses on the loose in central London



BBC London

- Published
1 July 2024

Military horses have broken free and run loose through central London for the second time since April.

Three horses from the Household Cavalry Mounted Regiment "became loose from their riders" while six were exercising on Monday morning, according to the Ministry of Defence (MoD).

All horses were recovered "swiftly and safely" and returned to Hyde Park Barracks by the Army and Metropolitan Police by 09:55 BST, with one receiving minor injuries. No soldiers were injured.

Four other military horses were spooked by noise from a building site in Belgravia on 24 April [and fled through the city, with some hitting vehicles including a double-decker bus.](#)



Image source, Jack Hanbury

Image caption,

The Army says one of the horses received minor injuries



Image source, @Davenoisome/PA Wire

Image caption,

A black cab driver caught some of the drama on his dashcam

The latest incident happened when the lead horse, which was being led rather than ridden, became loose after being spooked by a London bus.

Two riders were then unseated from their horses, who also became loose.

Part of the incident was captured on dashcam footage by a black cab driver.

The animals bolted from Seville Street to South Eaton Place, where one horse was recovered. Two horses continued to Vauxhall Bridge via Belgrave Road before being stopped.

None of the three horses were involved in the previous bolting incident from 24 April, the MoD added.



Image source, Kevin Kittoe/BBC

Image caption,

Two horses continued to Vauxhall Bridge before being stopped

Jack Hanbury was cycling to work when he heard "the distinctive sound of hooves galloping along the pavement" as he travelled from Chelsea towards Hyde Park.

"Then the three horses came into sight about 100m away and I pulled off the road to get out of their way," said the 30-year-old from Battersea, who works in finance.

"One of the horses veered on to a kerb avoiding traffic and fell over, hitting the hard ground, sliding for at least a metre before getting up and carrying on.

"It's the last thing you'd expect to find when you're heading to work in the morning."



Image source, PA Media

Image caption,

Horses from the Household Cavalry were seen galloping through central London back in April

An Army spokesperson said: "We can confirm that whilst exercising this morning, three horses from the Household Cavalry Mounted Regiment became loose from their riders. They were swiftly and safely recovered.

"One horse received minor injuries, but no further treatment is required and there were no injuries to the soldiers involved".

A spokeswoman for the Metropolitan Police said: "We're aware that a number of horses were loose in central London and worked with the Army to locate them.

"We're pleased to confirm that all of the horses have been accounted for. We are continuing to liaise with the Army."

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Riding under pylons - horse affected by electricity?

 scatty_mare ·  13 December 2013

13 December 2013

#1

A bit of a random post but bear with me!

Have recently moved to a new yard, and the sandschool is situated directly under overhead power cables, and one end is only about 40m from the pylon. When there is moisture in the air the electricity buzzes and crackles quite loudly.

My mare is a fizzy little excitable type anyway, and has always had days when she wants to do everything at the speed of light with her head in my face (yay) but usually she will settle after about 20 mins and work properly. Since we have been at this yard there have been a few days where she just doesn't settle at all, and seems completely wired - different from ever before. She's been fine out hacking and at competitions - but then she is an inconsistent little minx.

Has anyone had experience of electricity affecting their horse? Could she be feeling it through the ground?

Thanks for reading!

Joined: 17 June 2010
Messages: 514
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13 December 2013

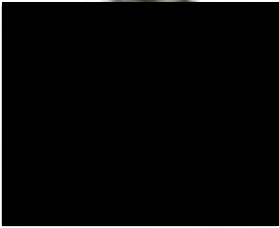
#2

Well, horses are more affected by electricity then we are, so it is possible. I would think that she will settle down after a while, 'tho. What are the other horses at the yard like?

Joined: 17 January 2009
Messages: 15,576
Location: Ireland
[Visit site](#)

13 December 2013

#3



Well-Known Member

Joined: 17 June 2010

Messages: 514

[Visit site](#)

I'm the only person who uses the school so I don't know.

It's funny though, it's just the odd day that something affects her. I will write down when it happens from now on and note whether it was a damp day - who knows!

13 December 2013

#4

P



Well-Known Member

Joined: 7 July 2008

Messages: 2,112

Location:

Hampshire / Berkshire

[Visit site](#)

I have a gelding on my yard that is worried by Electric pylons. He becomes spooky when it has been raining and we ride either along the line or under it.

Our lad is blind in one eye so his hearing is acute.

13 December 2013

#5

er

Not slacking
multitasking

Joined:

31 December 2008

Messages: 65,054

Location: Cambridge

[Visit site](#)

Frank hates the noise (and he isn't really a neurotic type).. on the basis that he also hates any white noise from speakers I put it down to the noise rather than the elec.

13 December 2013

#6



Well-Known Member

Joined: 5 March 2010

Messages: 11,764

Location: Glasgow

[Visit site](#)

Stray or induced voltages would be small from a pylon (unless one of the lines was down!) and I doubt a horse could detect them. However, they may well be sensitized to the fizzing/crackling sounds that pylons can make in damp weather.

13 December 2013

#7



Well-Known Member

Joined: 8 June 2012

Messages: 991

Location:

South East Kent

[Visit site](#)

My OH has painted pylons for many years and apart from the crackle he's not aware of any other potential issue, they would sometimes get a static shock if the pylon was on and they were very close to the cables but nothing more, however I have heard of some horses being particularly sensitive to them even when the weather is dry.

13 December 2013

#8



Well-Known Member

Joined: 8 August 2012

Messages: 5,757

Location:

Border of

Cheshire/Wirral/ N

Wales

[Visit site](#)

yes we have pylons on our farm ride and the horses get a bit fizzy near them

13 December 2013

#9



Well-Known Member

Joined:

8 November 2011

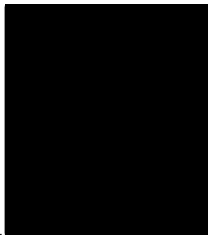
Messages: 2,145

[Visit site](#)

We have pylon wires running over our field and generally they don't cause a problem but there have been times when the bit has tingled, almost a mild buzzing, generally when theres close atmospheric pressure. Strange and I mentioned it to the man from the National Grid and he couldn't explain why.

13 December 2013

#10



Well-Known Member

Joined: 22 May 2009

Messages: 451

Location:

Halifax, West Yorkshire

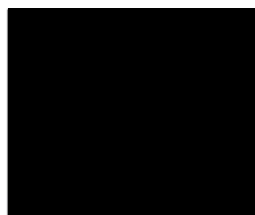
[Visit site](#)

We have lived on our farm 18 years now and we are directly under over head electric cables and our school is bang next to a pylon, it's buzzes and crackles when it's going to rain and when it's raining and in damp weather. Yes it definitely fizzes some horses up, we have a livery yard and it affects all different horses differently but we are also on top of a hill and it's always windy too. One horse freaked out and bolted straight through a dry stone wall with its rider which was quite nasty and they can be sharp when bringing in from the field. I bought my boy a set of those MoJo things that are supposed to deflect outside energies, I find these help but it could all be in my mind lol. Also I haven't lived there now for about 5 years but I always had head aches there and I'm sure it affects your health living so close to a pylon, I'm much better now I don't live there, I would never buy a property with a pylon close to the house. Sometimes when it's windy the electric wires hit each other and make a loud bleeping noise and that can really upset them.

Last edited: 13 December 2013

13 December 2013

#11



Well-Known Member

Joined: 17 July 2013

Messages: 245

[Visit site](#)

It is likely to make more of a noise when it is foggy. Your horse will need to get used to them. You could also measure the magnetic field emitted from the cables just to see if it is too high.

13 December 2013

#12



I wouldn't be concerned. My previous yard had pylons and cables overhead but none of the horses were adversely affected. My mare is very sensitive but she took no notice, even when they were buzzing and crackling.

Well-Known Member

Joined:
13 November 2006

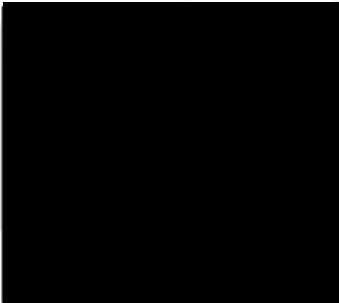
Messages: 5,369

Location: Yorkshire

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13 December 2013

#13



I have some right next to my yard, they crackle but never had a horse bothered by them. Also jump right under them at weston lawns again with no issues

Well-Known Member

Joined: 10 June 2009

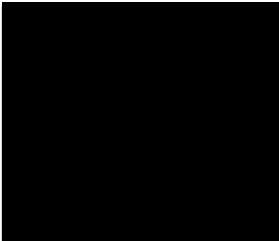
Messages: 3,348

Location: Staffordshire

Visit site

14 December 2013

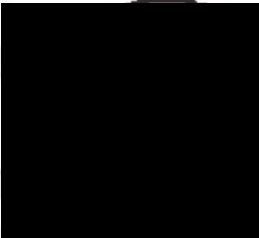
#14



There is a very good competing venue called Weston Lawns in Warks which has pylons over head. So many people from all over the place compete here and many have said it definately affects their horses. You can hear the crackling whenever its damp, drizzle, rain, sleet and snow. Some horses react as though they get little electric shocks from the ground through their shoes, (a bonus if your doing dressage!!) Other horses don't seem to be bothered by it, so i suppose it depends on your horse. A bit like us when we get electric shocks from other people, some get them more than others. I think once your horse gets used to it they will settle down.

14 December 2013

#15



I used to keep my horse at a yard where there were several electrical pylons over the pastures. If you went under the wires with bare feet, you could feel very light zaps running on your skin, and horses avoided them.

Well-Known Member

Joined: 28 April 2013

Style Chooser English (UK)

Messages: 764

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Newbury: 'Split cable' killed horses



INVESTIGATORS believe two horses that collapsed and died at Newbury racecourse at the weekend were electrocuted after underground cables were disturbed by workmen.



Racehorses Fenix Two and Marching Song dropped to the ground and died at Newbury

The meeting was abandoned after racegoers saw Fenix Two and Marching Song drop to the ground and die, apparently from a strong electric current underneath the paddock.

Trainers spoke of their horror as the horses were seemingly held to the floor by the current "for ages". One said: "It was like being in the electric chair."

Two other horses were seen to “wobble” and a lead rein on one dead animal showed traces of burning. People who went to aid the horses also felt shocks from them.

Fenix Two and Marching Song were due to feature in Saturday’s opening race when they reared up and collapsed in great distress. Another horse, Kid Cassidy, was withdrawn after stumbling.

A fourth, The Merry Giant, was also affected, but raced, finishing last in a “badly traumatised” state.

Newbury chairman Christopher Spence said: “It’s a nightmare. We all think it’s electric, but we don’t know.”

Engineers called to the Berkshire course yesterday found a cable, laid 42 years ago under the parade ring, which may recently have been disturbed. It was taken away for inspection.

Newbury joint MD Stephen Higgins said: “The two (horses) who died had steel shoes on and the two who were ok had aluminium plates on, so there’s a distinct possibility that the conductivity of the electricity has affected the horses and not humans.”

The cable may have been punctured during drilling to aerate the ground.

Fenix Two’s trainer, Jonjo O’Neill, said he noticed Kid Cassidy go down on its knees before his horse was struck. He said: “Mine was stuck to the ground. He was there for ages dying. It was like being in the electric chair.”

Experts said the course was unlikely to be sued. Daily Express racing correspondent Patrick Weaver said: “Trainers will have individual insurance for horses, but Newbury will also have its own all-embracing insurance policy.”

WHY THEY ARE SO VULNERABLE

HORSES are particularly prone to electrocution because of their physiology, experts say.

There have been numerous instances where horses have been struck dead by lightning, an occurrence much more common than with humans. It is believed the fact that the horse has four legs grounded at any one time rather than two – and often while wearing steel horseshoes – allows it to conduct electricity more freely.

Four horses died in a single lightning strike in the US last year. The four thoroughbred racehorses were killed in Jasper, Georgia, during a storm in July.

There have been numerous similar fatalities in the UK, although it is rare for more than one horse to perish in a single incident.

Experts say it was noticeable that during the horrific events at Newbury at the weekend, the horses received fatal shocks while the stable hands leading them out felt only minor shocks.



[< advice](#)

The 3Fs – Friends, forage and freedom

Find out how you can meet your horse's fundamental needs using the 3Fs.

Share this advice



As horse owners, riders and keepers, it is our duty to provide the horses in our care with a species-appropriate life centred around their three essential needs: friends, forage, and freedom.



Friends

Horses are highly social prey animals and, as such, socialisation with other horses is a vital part of their day-to-day life. Ideally, horses should be turned out as part of a herd as it helps them feel safe and build social bonds through behaviours such as mutual grooming, playing and having fun, and resting with one another. If this is not possible, then walking out in hand with at least one other horse is an option, along with making sure that horses are able to see other horses when turned out or in the stable. However, providing opportunities for physical contact is also important for horses' welfare and mental well-being.

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Forage

Horses are predominantly grazers and should be fed a forage-based diet. Forage can include grass, hay and haylage as well as chaffs and grass replacers. Forage is vital for digestive health: horses are hindgut fermenters and require cellulose in their diet for the bacteria in the caecum to break down to help provide energy. Forage is important for gut fill, as a suitably full gastrointestinal tract can help reduce incidences of colic and gastric ulcers. Forage also prolongs eating time, which is important for horses' mental well-being as they have a behavioural need to spend most of the day eating. Horses that don't have their behavioural needs met because they are fed a low forage, high sugar and starch diet are more likely to display unwanted behaviours. Alongside forage, most horses will need to be provided with additional vitamins and minerals in some form to ensure they are receiving the correct amounts of micronutrients. Where possible, try to make presentation of forage fun and interesting to make foraging an enrichment activity.



Freedom

Freedom of movement is important for horses' physical and mental well-being. Horses evolved to live on large home ranges and will move 10–20 km per day when given the opportunity. Although this is more challenging within most domestic environments, there are many ways to provide your horse with opportunities to move. Herd turnout in varied terrain is the best option, but any turnout will be beneficial, as will loose schooling. Riding and groundwork also encourage movement, but this is not normally within the horse's control.

'Freedom' doesn't just mean freedom to move – it also means freedom of choice. This is an important element of maintaining equine welfare and well-being.

Choice can be incorporated into your horse's life through offering different forage options and presenting forage in different ways (e.g., hay nets, hay boxes and loose). Different surfaces and areas can also be provided whilst turned out to incorporate choice. Being turned out in a group of horses also provides some element of choice in how they chose to free exercise, who they spend the majority of their time with, which other horse(s) they might play with, who they might mutually groom, rest alongside, etc.

Where possible, try and incorporate the elements of the 3Fs into your horse's daily management to meet their fundamental needs. It's time to get creative with your enrichment methods and have fun with your horse!

The 3Fs were developed by equine behaviourist, Lauren Fraser. You can find more information on Lauren's work and the 3Fs [here](#).

For more information on the 3Fs why not check out the [What are the 3Fs for horses?](#) episode in our video series, Horses Explained.

Last updated: 22/6/2026. Advice collated by the World Horse Welfare research and education team and externally reviewed by Rosa Verwijs, MSc FHEA CEBC ABTC-AAB

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Equine community urged to come together for horse welfare

RSPCA REPORT CALLS FOR A 'COLLABORATIVE EFFORT' TO IMPROVE LIVES OF ALL HORSES

HORSE OWNERS AND KEEPERS, THE EQUINE SECTOR AND GOVERNMENTS HAVE BEEN URGED TO WORK TOGETHER TO ENSURE ALL HORSES HAVE A GOOD FUTURE, IN A MAJOR NEW REPORT FROM THE RSPCA.

The report '[Horse sense: A good life for horses through strengthening the horse–human relationship](#)' launched at the 2025 National Equine Forum (6 March).



Commissioned by the RSPCA to identify the nature and causes of the current equine welfare situation, the report delves into the driving factors behind the well-documented 'horse crisis' of overbreeding, abandonment and neglect which began in 2012, but also reveals a wider issue of owned leisure and competition horses not having all their welfare needs met today.

The research, conducted by Human Behaviour Change for Life and their research partners from the University of Bristol and University College Dublin, offers a number of solutions and suggestions for improvements, including:

- Legislation and policy change
- Attitude and behaviour change
- Bridging gaps in knowledge and practical skills among horse owners and keepers

Dr Mark Kennedy, Senior Scientific and Policy Manager for Equines at the RSPCA said: "Everyone in the equestrian world will remember the horse crisis when it was at its peak a number of years ago - with dead or dying horses dumped on an almost weekly basis, and sadly charities like the RSPCA are still seeing some of the effects of those challenges today.

"Although the equine crisis has eased, it is not eliminated, and in fact it is more important than ever to look at horse welfare across the board, including leisure and competition horses too. That's why we've commissioned this important new report.

"The report finds that a diversity of equine welfare issues exists across the different groups of equines. These include obesity, lack of turnout, poor predictability (e.g. frequently changing homes and herd mates), gastric ulcers, delayed euthanasia, limited social interaction, rough handling and poor owner and keeper recognition of stress, pain and quality of life. Fortunately, the report reveals that there's a lot of work that can be done to drastically improve the lives of all of our horses.

"Our goal is to have an equine world where all horse keepers provide their animals with the opportunities to experience a good quality of life, and for agencies, like the RSPCA and many other organisations, to help keepers achieve this through new research, advice and by leading by example. This report brings together vital research and outlines a number of ways - such as legislation change and more education about the welfare needs of horses - in which horse owners, the equine sector and governments can all work together and be the driving force for change for horses everywhere."

Key issues identified in the report include inadequate equine-keeping facilities which fail to provide enough opportunities for turnout, grazing, and socialization, leading to unfulfilled welfare needs - known as the Three Fs- Forage, Friends and Freedom - leading to fewer opportunities for positive welfare and the ability to experience a good quality of life.

It identifies several key areas for action to address the issues identified, including calling on national governments to strengthen legislation where required and support local government and

other agencies in their enforcement role and introduce new legislation as is necessary, such as the regulation of livery yards and licensing of rescues and sanctuaries. It also emphasizes the role of colleges and equestrian organisations in addressing knowledge and practical skills gaps among horse keepers, and urges governments to include animal welfare in the national curriculum.

The report also makes suggestions for a boost in knowledge and practical skills in horse management, for colleges in developing their curriculum to address horse keepers' knowledge and practical skills gaps, as well as recommending that equine welfare charities and equestrian organisations ensure their training curricula address knowledge and practical skills gaps in their members.

Dr Kennedy added: "The RSPCA recently launched its new [Animal Futures report](#) which looks into how the world may look for animals by 2050, and how the decisions we make today will influence that outcome. We're concerned that without action from a number of stakeholders today, many horses face a challenging future - from a lack of grazing space for animals such as horses.

"We hope the publication of our Horse Sense report will play an important role in creating that better world for animals."



Horse sense:

A good life for horses' through strengthening the horse-human relationship



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Development near overhead lines

Planning and amenity aspects of high voltage electricity transmission lines and substations

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This document provides information for planning authorities and developers on National Grid's electricity transmission lines and substations. It covers planning and amenity issues, both with regard to National Grid's approach to siting new equipment, and to development proposals near overhead lines and substations.

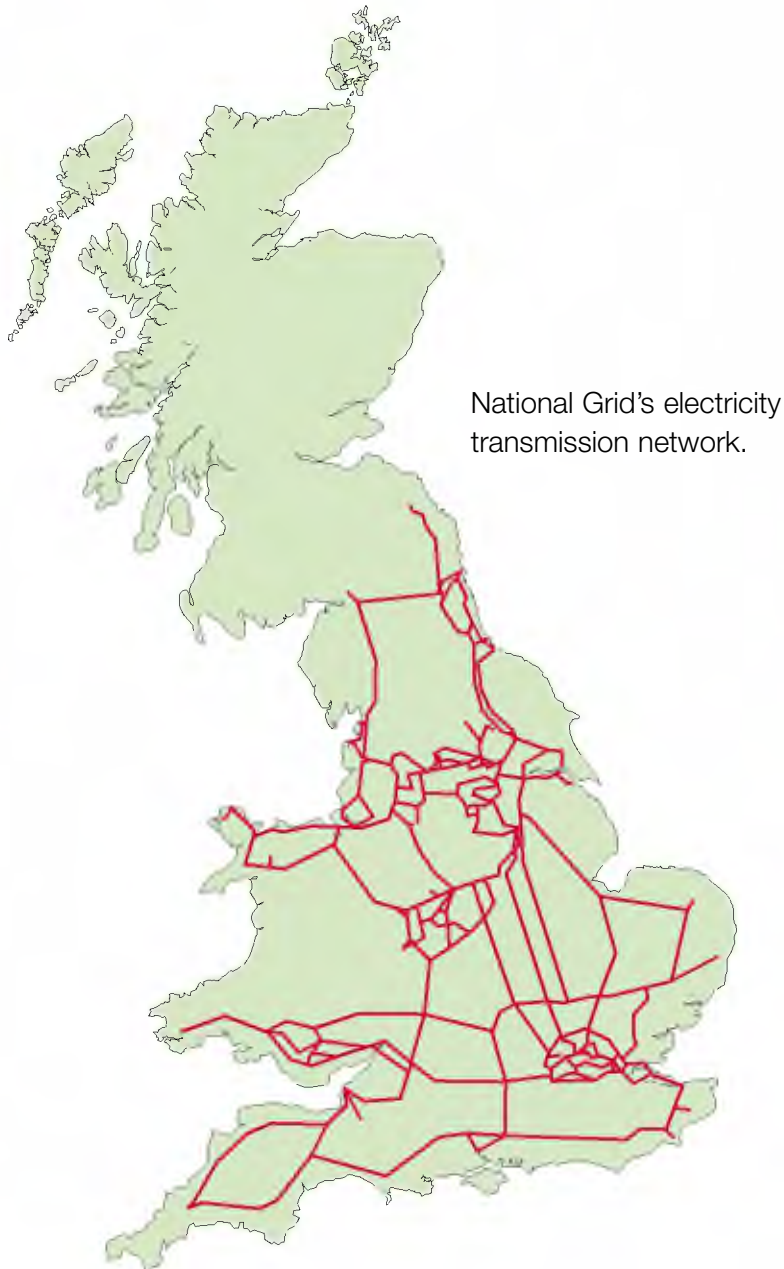
Who we are and what we do

Electricity is generated at power stations around the country. These power stations use a variety of fuels - principally coal, gas, oil, nuclear and wind - to generate electricity, and the stations are generally sited to be close to fuel and cooling water rather than to be near centres of demand.

Electricity is then transmitted from the power stations through a national network of electricity lines which operate at high voltage. National Grid owns the electricity transmission network in England and Wales and operates the electricity transmission system throughout Great Britain. Local distribution companies then supply electricity at progressively lower voltages to homes and businesses.

This transmission system which operates at 400,000 and 275,000 volts (400kV and 275kV) is known as the “national grid” and covers some 4,500 route miles of overhead line, 420 route miles of underground cable and more than 335 substations. The system, which connects the electricity generators’ power stations with the networks of the local distribution companies, also connects with some large industrial customers who, by reason of their size and technical characteristics or location, are directly connected to the transmission system.

Under the Electricity Act 1989 National Grid is the holder of a transmission licence. It is required in this capacity to develop and maintain an efficient, coordinated and economical system of electricity transmission and to facilitate competition in the supply and generation of electricity.



Unlike virtually all other commodities, electricity cannot be stored in bulk until it is needed; it has to be generated in the right quantities, at the time it is needed. The vast majority of generating capacity in England and Wales is connected by National Grid's transmission system. This enables the operation of power stations to be coordinated, offering potential benefits of reducing the amount of spare generating capacity and generating reserve needed, and the ability to select power generation to supply the needs of the moment.

The energy industry is currently going through a period of significant change resulting in a multi-billion pound investment programme. This will encompass small and large scale electricity generation and substantial investment in energy networks to replace and upgrade ageing assets, construct new infrastructure to connect and efficiently deliver new energy sources, as well as maintaining the levels of safety and reliability to which everyone has become accustomed.

This note describes National Grid's amenity responsibilities. It briefly sets out both the amenity aspects which National Grid takes into account in siting new electricity lines and substations, and the amenity aspects which are relevant to proposed development near National Grid's electricity transmission equipment. The note goes on to explain these considerations in more detail, which we believe developers and local planning authorities may wish to take into account.



Overhead lines and substations

An electricity line consists of either an overhead line or an underground cable, or both. A typical National Grid overhead line route uses three main types of lattice steel tower (or pylon). These are:

- suspension towers which support the conductors on straight stretches of line;
- deviation towers at points where the route changes direction; and
- terminal towers where lines terminate at substations or are connected to underground cables.

Appendix II illustrates these features.

National Grid's substations are necessary for the efficient operation of the transmission system, for the specific role of switching circuits or transforming voltage. They are normally sited between power stations and the transmission network, and between the transmission network and the local distribution companies' networks. They can be sizeable developments, and including connecting terminal towers, can occupy up to 20 hectares.



However, advances in technology means that the equipment located at substations is now more compact than that of the 1950s and 1960s when many of the existing substations were built. Hence new substations are considerably smaller in size, both in height and area covered, and in certain circumstances, can be sited inside a building which resembles an industrial unit. Substations are usually contained within steel palisade fencing to ensure public safety, and the structures, excluding towers, are not usually more than 15m in height. Road access is necessary for staff, and for the transport of equipment during construction, maintenance or repair. Very occasionally, transformers or other very large items of plant may need to be moved into or out of sites as abnormal indivisible loads.



Consent procedures

National Grid is a statutory undertaker under the Town and Country Planning (General Permitted Development) Order 1995. The Order grants planning permission for certain defined classes of development. National Grid therefore has certain rights to carry out development under the Order without the need for planning permission from the local planning authority. This permitted development relates primarily to development in existing substations, on operational land and to underground cables. New substations or major extensions to existing substations may require planning permission from local planning authorities.

To construct a new overhead line in either England or Wales, National Grid requires formal consent, under section 37 of the Electricity Act 1989, from the Secretary of State for Business, Enterprise and Regulatory Reform, unless the new line is across land owned and occupied by the company. The Electricity Act 1989 contains a formal procedure for consultation with local planning authorities within whose areas the new line is proposed. If they maintain an objection to an application for section 37 consent then the Secretary of State is required to convene a public inquiry. When granting section 37 consent, the Secretary of State will usually direct that planning permission for the development will be deemed to be granted under the Town and Country Planning Act 1990.

Advice on the procedure for consulting local planning authorities is given in a Circular issued jointly by the then Department of the Environment (Circular 14/90 of that office) and the then Welsh Office (Circular 20/90).

Under its duty in the Electricity Act 1989 to facilitate competition in the supply and generation of electricity, National Grid must offer connection facilities to any new or proposed power station or plant, including offering connections to a local distribution company or major industry that requires a high voltage electricity supply. Therefore proposals for a new electricity generation project may also involve transmission works away from the power station site, such as new overhead lines, modifications to existing lines or new development at substations. These transmission works may be the responsibility of National Grid, the distribution companies or the generator itself depending upon the particular circumstances of each case.

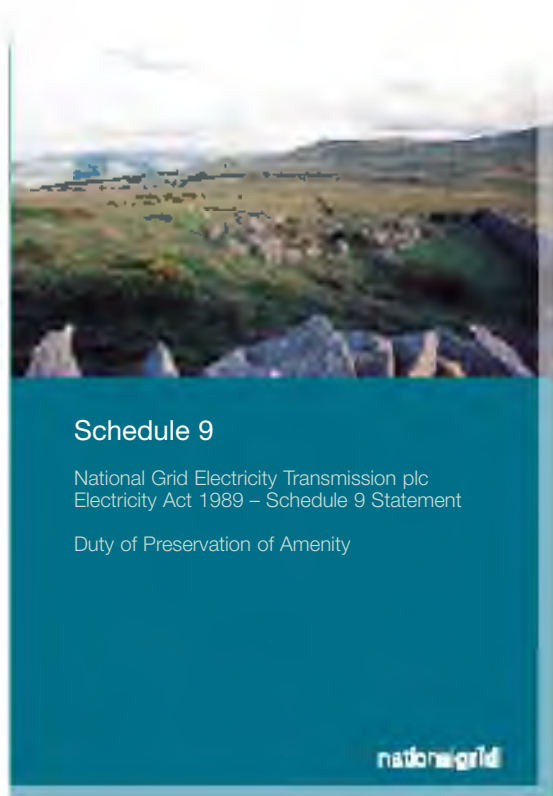
A generator promoting a new power station of over 50 megawatts generation capacity would seek consent under section 36 of the Electricity Act 1989. Although such an application would be separate from any associated transmission works, discussions between the generator and National Grid normally take place at an early stage. Indeed, National Grid would encourage prospective generators to consult it in advance of the consent process so that transmission and consent implications of the project can be fully considered.

Amenity responsibilities

Schedule 9 Statement

Under section 38 of the Electricity Act 1989, National Grid has a duty in formulating proposals for new development to “have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest; and shall do what [it] reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects.”

National Grid is also required under schedule 9 of the Act to produce and publish a statement setting out how it proposes to meet this obligation. The company’s Schedule 9 Statement is available as a separate document.
<http://www.nationalgrid.com/uk/LandandDevelopment/SC/Responsibilities/>



Environmental Impact Assessment

Overhead lines with a voltage of 220kV or more and a length of more than 15km which require consent under section 37 of the Electricity Act 1989 are included in schedule 1 of The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 (as amended). These regulations implement European Directive 85/337/EEC as amended by Directive 91/11/EC which set out procedures for the assessment of the effects of certain projects on the environment. For all development listed in schedule 1 of the regulations, the preparation of an environmental statement is mandatory. As such National Grid will always undertake an environmental impact assessment of all new high voltage overhead line routes of more than 15km in length and submit an environmental statement.

A separate list of developments is covered in schedule 2 of the regulations. A schedule 2 development project need only be subject to environmental assessment if it is likely to have a significant effect on the environment because of its size, nature or location. The regulations state that where proposals include a high voltage overhead line or an overhead line installed in a sensitive area, the need for an environmental impact assessment will be determined on a case-by-case basis. National Grid will therefore carry out environmental impact assessments for some overhead line developments which fall into schedule 2, dependent on consultation with the relevant local planning authorities and the outcome of the screening process.

Environmental statements are not required under the legislation for new substation proposals, however National Grid has given a commitment in its' Schedule 9 Statement to undertake relevant environmental investigations and report on these in any application for consent for new works.

Routeing of overhead lines

Guidelines for the routeing of new overhead lines were originally formulated by the Central Electricity Generating Board (CEGB), a predecessor to National Grid. These guidelines have subsequently been reviewed and supplemented by National Grid and are used as the basis of the company's approach to routeing new overhead lines.

The guidelines set out the principles to be applied in the routeing of new overhead lines. They cannot be expected to cover every possible situation and each case must be considered separately and on its own merits.

The selection of any new electricity line route will be a balance of all the various factors or constraints which have to be taken into account. Any overhead line will be a visual intrusion into the landscape through which it passes, and it is the dominant scale of towers which makes them difficult to absorb into the landscape.

In selecting a route National Grid seeks to reduce the visual effect of the line in terms of the number of people affected and the degree to which they are affected. The nature and topography of the landscape is considered and any statutory protection afforded to an area is also taken into account.

The selected route will typically seek to avoid crossing the highest contours, where towers would generally be the most prominent and will take account of the quality of the landscape and its ability to accommodate an overhead line. In other words an overhead line should 'fit' into the landscape as much as that landscape permits. The extent to which opportunities exist to screen the line will depend on existing vegetation, buildings and topographic features. When viewed from principal viewpoints, an overhead line should ideally be viewed against a background of existing landscape or other development rather than against the sky.

There may be a number of potential conflicts of interest in establishing a new overhead line route. Sometimes, for example, the best route through a landscape will be to follow a river valley rather than to cross the adjacent higher land. The valley, however, is likely to be more intensively populated and also may contain the major transport routes in the area as well as the better quality agricultural land. A new line so routed could have a greater effect on a larger number of people even though its effect outside the valley may be minimal. Conversely for example, upland areas, whilst having relatively little development, are likely to have protective designations and an overhead line across such areas may be visible over a much wider area.

These are all general routeing principles. In practice, the selection of a route will very much depend on the circumstances applicable to each case.



Siting of substations

The general location of a substation is initially determined by transmission requirements and line routeing. The substation may be required to increase the supply of electricity from a power station into the national grid system for transmission; or near an urban area, it may be required as a grid supply point to reduce the voltage to lower levels for the local distribution companies. Its general location is defined by these factors.

With regard to the precise location of a substation, National Grid has guidelines to assist in siting and designing substations to mitigate their environmental effects. The substation guidelines complement National Grid's line routeing guidelines and, where appropriate, are used in conjunction with them.

Proposals for new or significant extensions to substations, do not require environmental impact assessment under Government regulations or advice. However, National Grid normally undertakes relevant environmental investigations on such proposals, and would report on these investigations in submitting any planning application to the local planning authority.



This image shows an aerial view of St. John's Wood 400kV substation in north London. Amongst other factors, design of this GIS (gas insulated switchgear) substation had to take into account land constraints in this urban area.

Development near overhead lines and substations

National Grid owns the land occupied by its substations, but only exceptionally does it own the land which is crossed by its electricity lines. The line is retained by means of either wayleave agreements or permanent easements with the landowner. National Grid has the power to maintain and renew the electricity line and to gain access for these purposes.

National Grid seeks voluntary agreements with landowners. However, when these are not forthcoming National Grid has compulsory powers and can apply to the Secretary of State for a 'necessary wayleave' for the overhead line route, or compulsory purchase of the land occupied by the cable route. In such cases a hearing will take place which provides the opportunity for all issues to be discussed. Since it does not own the land, it cannot prevent development close to or under overhead lines (although, of course, safe electrical clearances must be maintained).



It has sometimes been suggested that minimum distances between properties and overhead lines should be prescribed. National Grid does not consider this appropriate since each instance must be dealt with on its merits. However, it has always sought to route new lines away from residential property on grounds of general amenity. Since the only limitation on new development has been the statutory safety clearances (Appendix III), a large amount of residential and other development has been carried out subsequently beneath and adjacent to overhead lines.

Where development takes place and how it is designed are principally matters for the landowner, developer and the local planning authority to determine. National Grid should be consulted at an early stage on proposals for development near lines and substations, when it is more likely that National Grid's advice and guidance on development near to electricity lines issues can be taken into account.

National Grid believes that the amenity considerations which are applied in routing overhead lines and siting substations, should be considered in respect of development proposed in the vicinity of overhead lines and substations. Such amenity and other considerations are set out below. In addition National Grid has published comprehensive site layout, design and landscaping guidelines to provide advice and pragmatic solutions for anyone involved in the planning, design and development of sites near high voltage overhead electricity lines.

Visit the Sense of Place website at:

www.nationalgrid.com/uk/senseofplace



Safety aspects

Contact by people or objects with high voltage equipment must be avoided. At substations the high voltage compound is protected by the provision of high security fencing and all of National Grid's towers have anti-climbing guards. For overhead lines a statutory minimum safety clearance must be maintained between conductors and the ground: the higher the voltage of the line, the greater the clearance which is required. Appendix III gives information on statutory safety clearances and on where further information and advice can be obtained.

Safe clearances must be maintained from buildings constructed under or adjacent to overhead lines. Safe clearances must also be maintained for trees, structures such as street lighting, new roads, and ground levels where these will be altered by civil engineering operations.

Underground cables give rise to particular safety requirements. Requirements are dependent upon cable installation methods but generally the area above cables, and a distance on either side, must be kept clear of structures and trees. Access is required for maintenance and repair. It is essential that the cables and material surrounding them should not be disturbed. Further information on cables is available on our website.

Maintenance

From time to time access is required onto land to inspect, maintain and refurbish overhead lines and underground cables. National Grid's rights of access to undertake such works are contained within the wayleave agreement or permanent easement with the landowner.

Overhead lines are inspected on a routine basis both by foot and helicopter. Climbing inspections of towers also take place. Less frequently, overhead lines are refurbished; and conductors, insulators and associated fittings may be replaced, or towers painted. Occasionally towers and their foundations may also be refurbished.

For major refurbishment, such as replacing conductors, safety scaffolding may need to be erected over underlying properties, roads and other development. Certain maintenance techniques also involve the use of helicopters.

National Grid needs quick and easy access to carry out maintenance to its equipment, to ensure that it can be returned quickly to service and be available as part of the transmission system. Such access can be difficult to obtain without inconveniencing and disturbing occupiers and residents, particularly where development is in close proximity to overhead lines.

National Grid recognises that maintenance and refurbishment activities can cause disruption and adversely affect the general amenity of those occupying buildings beneath or adjacent to overhead lines and near to cable routes. Where possible, National Grid seeks to minimise the effects of such disruption. Developers should take into account the requirement of National Grid to maintain access to its equipment.



Visual impact

Since towers are such large and dominant structures, the opportunity to mitigate their effect on new development adjacent to an existing line is restricted. Nevertheless the layout of residential and other types of development, the orientation of main views out of a building, and the location of structural site planning by the developer can assist in reducing the visual impact on residents.

For further information please visit the Sense of Place website at:
www.nationalgrid.com/uk/senseofplace

The siting, design and landscape treatment of new substations takes account of existing development. Landscaping, both through the modification of ground form and by planting, can help to mitigate the visual impact of a substation. Where new development is proposed in the vicinity of existing substations, the layout and design of the development can be planned to keep the adverse visual impact of the substation to a minimum.



Noise

High voltage overhead lines and substations can generate noise, the level of which depends mainly on the voltage of the overhead line or substation.

Noise from energised overhead lines is produced by a phenomenon known as “corona discharge” (a limited electrical breakdown of the air). While conductors are designed and constructed to minimise corona discharge, surface irregularities caused by damage, insects, raindrops or pollution may locally enhance the electric field strength sufficiently for corona discharges to occur. This can be audible in certain conditions as a “crackling” sound, occasionally accompanied by a low frequency hum. The noise level generated by a high voltage overhead line is weather-related, with highest noise levels occurring during damp conditions. Overhead lines are normally quiet during dry weather, except during long, dry spells when airborne debris adheres to the conductors. Any noise disappears when sufficient rain falls to wash the debris away.

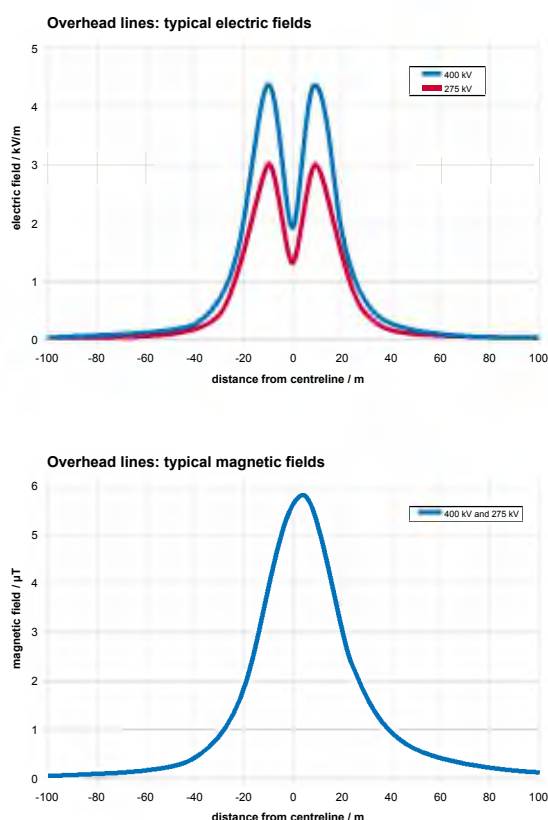
Transformers are installed at many substations, and generate low frequency hum. Whether the noise can be heard outside a substation depends on a number of factors, including transformer type and the level of noise attenuation present (either engineered intentionally or provided by other structures).

National Grid is able to provide information and advice on noise from high voltage plant to both planning authorities and developers. It is possible for the developer to mitigate significantly the effects of noise from an existing overhead line by attention to site layout and design of new developments, for example by including landscaping or by placing the noise-sensitive elements away from the high voltage plant.

The Department for Communities and Local Government Planning Policy Guidance 24 (PPG24, Planning and Noise), and Technical Advice Note (Wales) 11, guide local authorities on the use of their planning powers to minimise the adverse impact of noise. They outline the considerations to be taken into account in determining planning applications both for noise-sensitive developments and for those activities which generate noise. They also advise on the use of conditions to minimise the impact of noise.

Electric and magnetic fields

Electric and magnetic fields (EMFs) are associated with most electrical apparatus, including power lines, underground cables and domestic appliances. They diminish rapidly with distance from the source. Electric fields are associated with voltage and can cause small micro-shocks in certain instances (see “Other Electrical Effects” below). Magnetic fields vary with the current in the line or appliance. Both can be measured with appropriate meters. A separate guide to EMFs, “EMF The Facts”, is available.



While there is ongoing debate over the possibility of a hazard to health from low-level EMFs, the balance of the scientific evidence to date is against there being health effects.

The Health Protection Agency (HPA, previously the National Radiological Protection Board) is responsible for monitoring the hazards to health from all forms of radiation, and is highly respected for its independent scientific opinions. The Government relies on the scientific advice of the HPA, and has brought EMF exposure limits into force in the UK accordingly.

All of the electricity system, including all overhead lines, complies with these limits. The limits are set to prevent all established effects of EMFs on people, and the HPA advises that there is insufficient evidence of harmful effects (for example, cancer) below these levels to reduce the limits. The Government are considering whether any precautionary measures might be justified in addition to the exposure limits, based on a report from a stakeholder group called SAGE, but have not yet introduced any. Therefore, in the UK at present, there are no restrictions on EMF grounds on building close to overhead lines.

National Grid follows the advice of the Government and the HPA. National Grid recognises that some public concern exists over this matter. National Grid, together with the Energy Networks Association, can provide information on the research carried out worldwide on this subject or, alternatively, can direct interested parties to experts, independent of the electricity industry, who can provide advice and guidance.

Other electrical effects

Induced voltages

High voltage equipment produces electric fields which can cause nearby conductive objects to acquire a charge. When discharged to earth through a person touching the object, a small microshock may be experienced. For instance, a car parked under an overhead line can pick up a voltage and when a person touches it, a small spark may occur between the car and that person. Microshocks may sometimes be annoying, but are not normally regarded as dangerous or a health risk.

Metal-clad buildings and metal fences under overhead lines can similarly pick up a voltage. These should be appropriately earthed to reduce the effect of such voltages.

Magnetic fields from power cables and overhead lines can also induce voltages on conductive services, such as pipelines or telecommunication cables, that run parallel and close by. These voltages can be significant if the length of parallelism is considerable. In such cases, an assessment of the impacts of induced voltages will be required and National Grid should be consulted for further advice.

At petrol filling stations and other sites where flammable materials are stored, where spark discharges can be a safety hazard, appropriate electrical screening and earthing of the site may be required if it is located under a high voltage overhead power line. A safety assessment should be carried out with the effects of the nearby power line taken into account, and National Grid consulted for further advice.



Computer screen interference

Some monitors or display screens used with computers suffer a distortion of the displayed image, usually a “flicker” or “wobble” in the presence of 50 Hz magnetic fields above about 0.5 microteslas. Such magnetic fields can be found around most electrical equipment, including high voltage overhead power lines. The magnitude of interference will be dependent on the proximity and orientation of the display screen to the overhead line and the magnitude of current flowing in the line. Flat Screen Displays are not affected.

Distribution wiring in buildings and adjacent equipment can also generate a magnetic field of sufficient level to interact with computer screens.

For existing equipment that is being affected, there are techniques available that can reduce the interference. National Grid can provide information and advice to minimise interference to computer screens in the design and layout of new buildings. If Flat Screen Displays are specified for new installations, the need for any such mitigation will be removed.

Electromagnetic compatibility (EMC) issues

Some electronic and radio communications equipment may be susceptible to the electromagnetic fields and low level radio noise produced by high voltage equipment. Generally, it is easier and less costly to design and plan to avoid EMC issues than it is to correct the problems after they have arisen. As such, it would be prudent for the electromagnetic environment to be taken into consideration when new electronic equipment is being specified.

The locations of television and radio aerials relative to high voltage electricity transmission lines or substations can sometimes result in poor reception. The careful siting of such aerials can usually resolve this issue.

Development plan policy

Many of the considerations which have given rise to National Grid's approach to the siting of substations and the routing of lines are also relevant to proposals for development close to such high voltage plant.

Some local planning authorities have included policies in their development plan documents which state that, when considering new development, the effect of overhead lines on amenity should be taken into account. National Grid believes that this is an appropriate approach. While National Grid cannot control development (except for safety reasons) under and adjacent to lines, it believes that there are operational benefits to National Grid, and amenity benefits to potential occupiers and the local community, in controlling the siting of such development.

National Grid will support policies in development plan documents which seek to control, on amenity grounds, built development under and immediately adjacent to lines. National Grid is pleased to be consulted on relevant development plan policies and wishes to encourage dialogue with local planning authorities in order to achieve these objectives.

National Grid cannot support policies or proposals in development plans which rely on EMF and related health concerns as justification to control or direct development and will therefore continue to make representations against such policies.

As previously stated, it is National Grid's policy to adhere to HPA (previously NRPB) guidelines.

By appropriate site design it is often possible to incorporate amenity areas free of built development along a overhead line route and round a substation without sterilising significant areas of land.

Appropriate uses for this land are public open space; nature conservation; or structural landscaping in residential areas, or for parking and storage in employment areas. For further information please visit the Sense of Place website at:

www.nationalgrid.com/uk/senseofplace

National Grid wishes to encourage local planning authorities to consult it on draft development plan documents and on planning applications. It would particularly welcome discussions early in the development plan documents process.

Appendix I

Glossary

The following terms are generally used by National Grid in relation to its transmission equipment:

Cable

An insulated conductor designed for underground electricity transmission or distribution.

Central Electricity Generating Board (CEGB)

Until March 1990, the CEGB was responsible for the generation of electricity in bulk and the transportation of this power through a nation-wide transmission system called the national grid to the then Area Boards.

Circuit

Term used to describe specific electrical paths on the transmission system. i.e. Overhead Line.

Conductor

Wire strung between towers, used for transmitting electricity.

Damper

Metal devices fixed to insulators to avoid conductor damage in windy conditions which can cause vibration of the conductors.

Development Plan Documents (DPDs)

Planning documents prepared by local planning authorities to outline key development goals. DPDs cover the core strategy for the area, a proposals map and site-specific development allocations.

Earth wire

Wire strung between the tops of towers, used for lightning and system protection. This wire may also be used to carry telecommunication signals.

Electricity line

Either an overhead line or an underground cable used to transmit electricity.

Electric and magnetic fields (EMFs)

Electric and magnetic fields (EMFs) are produced by any electrical apparatus, including domestic appliances and overhead power lines.

Flashover

A disruptive electrical discharge between equipment at phase voltage and earth, or between two phases, including breakdown across the surface of an insulator as well as sparkover through air.

High voltage

275,000 volts and over. National Grid's transmission lines generally operate at 275,000 volts and 400,000 volts. Lower voltage lines, such as 132,000 volts and 33,000 volts are generally owned by local distribution companies.

Insulator

Used to attach the conductors to the towers preventing electrical discharge to the steelwork. Usually made from porcelain or glass units, joined together to form an insulator string.

kV

Kilovolt (one thousand volts).

Local distribution companies

Generally own and operate lines with a voltage of 132,000 volts and below and supply electricity to homes and businesses.

MW

Megawatt (one million watts or one thousand kilowatts).

Outage

The withdrawal from service of any part of the transmission system for a period of time in connection with repair, maintenance, or construction of the transmission system.

Permanent easement

Legal right in perpetuity granting National Grid the right to install, use and maintain its equipment. A permanent easement is granted in exchange for a one-off capital payment. Also known as a Deed of Grant of Easement.

Pylon

See tower.

Refurbishment

Repair and renewal of conductors, earthwire, fittings and insulators and where necessary remedial works to the tower and foundations.

Route mile

The length, measured in miles, of the transmission line which connects two or more points on a transmission system, irrespective of the number of circuits of which the line is comprised.

Spacer

Metal device which maintains conductor separation at intervals along the span between towers.

Substations

Transforming or switching stations to control the voltage and direction of electricity. Transforming stations are used to increase the supply of electricity (to 275kV or 400kV) into the national grid system for transmission, and to reduce the voltage to lower levels (to 132kV) for distribution by the local distribution companies. Switching controls the direction of electricity and ensures fault protection.

System security

The ability of a transmission or distribution system to withstand a disturbance and/or the loss of certain circuits.

Tower

Overhead line structure used to carry overhead electrical conductors, insulators and fittings. They are commonly known as pylons and are of a lattice steel construction. See Appendix II.

Wayleave agreement

A licence granted by the owner and occupier of land giving National Grid the right to install, use and maintain its equipment. Terms of the Wayleave Agreement provide for the annual rental and compensation payments to be made.

Appendix II

Main features of a transmission line

National Grid uses a variety of tower designs for the support of overhead line conductors which transmit high voltage electricity from generating stations to where it is needed.

The national grid until the late 1950s consisted of a series of overhead lines at a voltage of up to 132kV. As demand grew, a system of 275kV lines was developed to feed the major conurbations. This system was further developed and uprated to 400kV in the 1960s. A 400kV line carries about three times as much power as a 275kV line, and about 18 times that of a 132kV line depending on the precise line designs. Local distribution companies generally own and operate lines with a voltage of 132kV and below.

Figure 1 shows National Grid's L2 and L6 double circuit towers which are those most widely in use for high voltage transmission. The L2, a typical transmission tower from the 1950s, carried steel-reinforced aluminium conductors in pairs from each insulator. When quadruple conductors were introduced in the 1960s, larger and more substantial towers were needed. The L6 designs were then introduced. The development of lighter all aluminium alloy conductors allowed the smaller L12 design to be brought into use in the 1980s.

The size, height and spacing of towers are determined by safety, topographical, operational and environmental considerations.

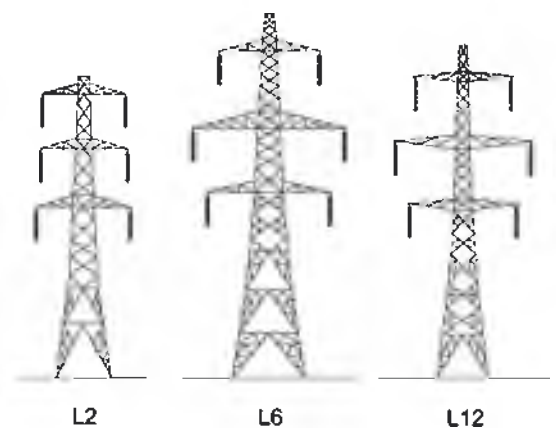


Figure 1: Typical suspension towers

A typical National Grid overhead line route will involve the use of three main types of tower. They are as follows:

- Suspension towers – these support the conductor on straight stretches of line. Conductors are suspended by a vertical insulator string
- Deviation towers – these occur at points where the route changes direction. Conductors are attached by horizontal insulator strings
- Terminal towers – these towers are of greater bulk in order to ensure stability. They occur at the end of overhead lines where they connect with substations or underground cables.

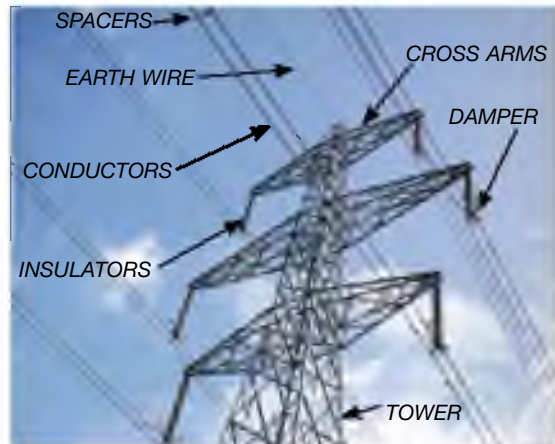


Figure 3: The main features of a transmission line

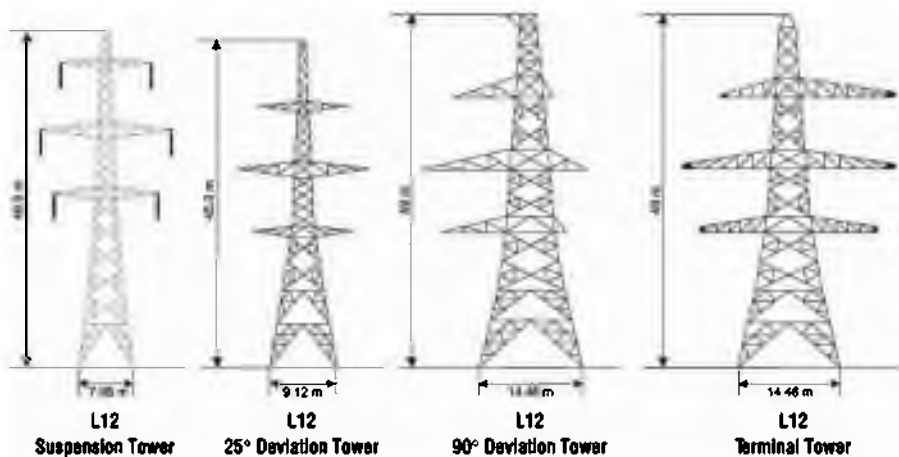


Figure 2: Typical towers in a 400kV route

Appendix III

Safety clearances

Making contact or near contact with overhead lines is dangerous. Overhead electric conductors are normally bare (uninsulated) and if an object approaches too closely it is possible that a flashover will occur and an electric current flow with the likelihood of fatal or severe shock and burns to any person nearby. In order to prevent such incidents minimum safety clearance for overhead lines are prescribed.

Overhead transmission lines must conform to the specifications contained in the Electricity Safety, Quality and Continuity Regulations 2002. The minimum heights at which the conductors are strung between towers are given for lines operating at specified voltages.

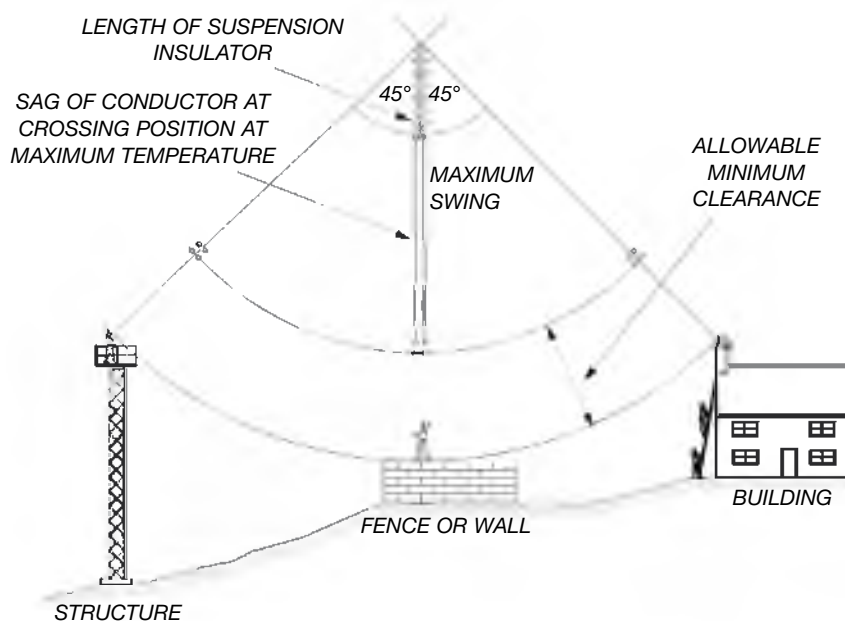


Figure 4: Clearance to objects (on which a person can stand)

Overhead lines are also constructed to conform with the Energy Networks Association's (ENA's) technical specifications which govern the minimum clearance to be maintained between the conductors, ground, roads, trees and objects on which a person may stand. A summary of ENA's Technical Specification 43-8 "Overhead Line Clearances" is given in table 1, the application of safety clearances are illustrated in figures 4, 5 and 6. The minimum clearance to ground for a 400,000 volt line is 7.6m and for a 275,000 volt line is 7.0m.

It is important to note that the information in table 1, giving the minimum safety clearances is for illustrative purposes only. The necessary clearance at a specific location will be dependent on factors including the location the line is passing over, the line's construction, design, and its operating voltage. It is therefore important to contact National Grid where it is intended to construct or alter the ground levels within the vicinity of a National Grid overhead line so that detailed advice on safety clearances and other relevant information may be given.

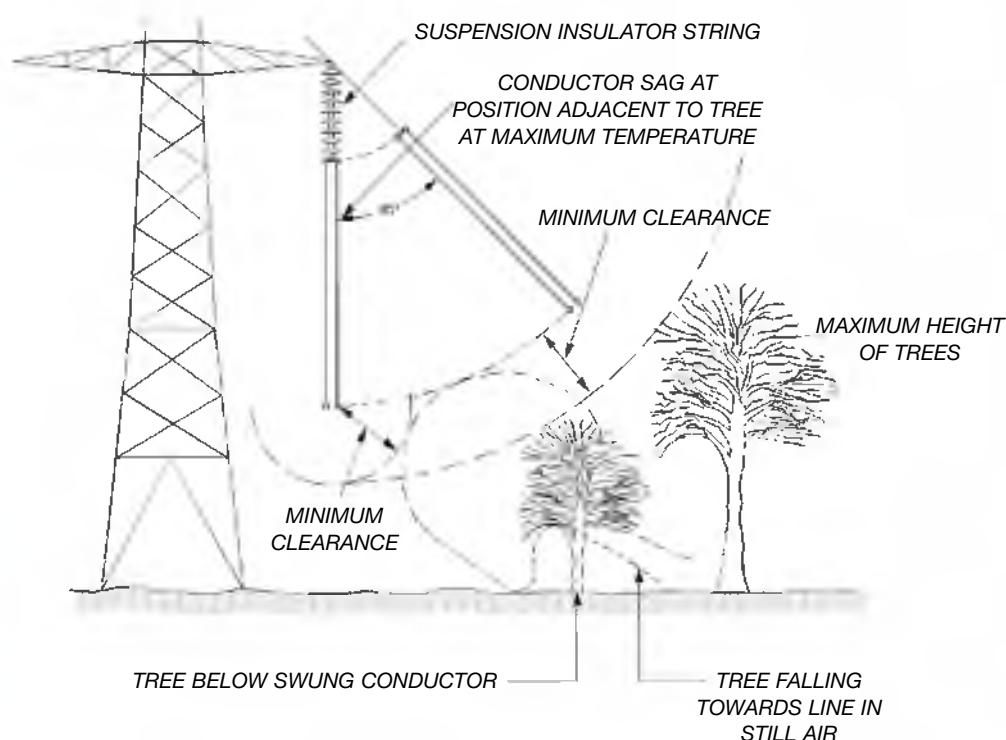


Figure 5: Clearance to trees

In order to ensure that safety clearances are not infringed where works are planned near to overhead lines, National Grid can provide profiles of the overhead line crossing specific sites which detail the height above ground of the lowest conductor. Line profiles are drawn at the time of construction to illustrate the position of the conductors at maximum sag. The position of the conductors at maximum swing should also be taken into account.

Developments adjacent to overhead lines should be designed to facilitate their construction without infringing electrical safety clearances. Care should be taken when unloading, stacking or moving material under conductors. Those involved should be acquainted with the Health and Safety Executive Guidance Notes GS6(rev) and HSG47 which advises on the avoidance of danger from overhead electrical lines and underground services respectively.

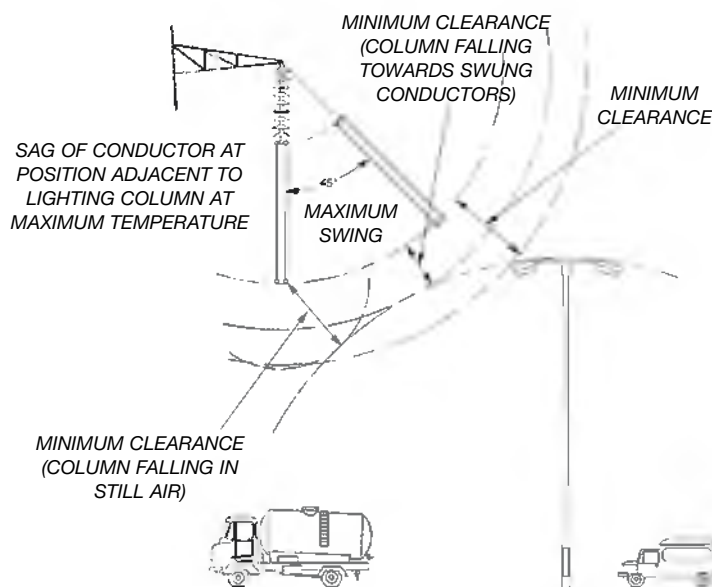


Figure 6: Clearance to lighting columns

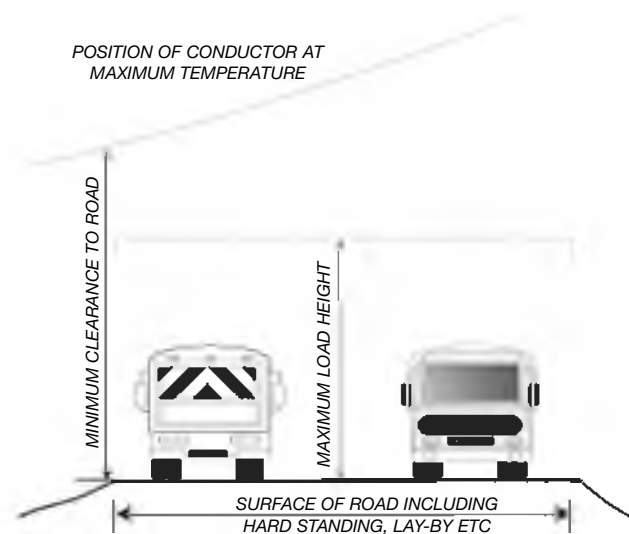


Figure 7: Clearance to roads

Table 1: Overhead line conductor clearances

Description of Clearance	Minimum clearance (metres) at 400kV	Minimum clearance (metres) at 275kV
To ground	7.6	7.0
To normal road surface	8.1	7.4
To road surface of designated '6.1 metres high load' routes	9.2	8.5
To motorway or other road surface where Skycradle can be used	10.5	9.8
To motorway road surface where scaffolding is to be used on:		
(i) Normal 3 lane motorways	16.3	15.6
(ii) Elevated 2 lane motorways	13.3	12.6
To any object on which a person may stand including ladders, access platforms etc.	5.3	4.6
To any object to which access is not required AND on which a person cannot stand or lean a ladder	3.1	2.4
To trees under or adjacent to line and:		
(i) Unable to support ladder/climber	3.1	2.4
(ii) Capable of supporting ladder/climber	5.3	4.6
(iii) Trees falling towards line with line conductors hanging vertically only	3.1	2.4
To trees in orchards and hop gardens	5.3	4.6
To irrigators, slurry guns and high pressure hoses	30.0	30.0
To street lighting standards with:		
(i) Standard in normal upright position	4.0	3.3
(ii) Standard falling towards line with line conductors hanging vertically only	4.0	3.3
(iii) Standard falling towards line	1.9	1.4

References

- The Electricity Safety, Quality and Continuity Regulations 2002 (S.I. 2002 No 2665).
- Energy Networks Association Technical Specification 43-8 Issue 3, 2004 - Overhead Line Clearances.
- Health & Safety Executive Guidance Note GS6(rev) - Avoidance of danger from overhead electrical lines.
- Health & Safety Executive Guidance Note HSG47 - Avoiding danger from underground services (Second edition).

Contacts and further information

A. For planning application consultations, developer enquiries and advice on safety clearances, please contact the following:

Asset Protection Team
National Grid
Land and Development
PO Box 3484
Warwick
CV34 6TG
Switchboard: 0800 731 2961
Fax: 01926 656574

B. For development plan document consultations, general town and country planning and amenity issues, please contact the following:

Land and Development Stakeholder and Policy Manager
National Grid
National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA
Tel: 01926 653000
Fax: 01926 656574

C. For questions on, or issues with, EMF please contact the following:

EMF Unit
National Grid
National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA
Tel: 0845 7023270
Email: emfhelpline@uk.ngrid.com
Web: www.emfs.info

Land and Development
Stakeholder and Policy Team
National Grid
National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

nationalgrid.com

nationalgrid

July 2008

Annex 1 – Field Map

Writtle University College Estate: Fields

Arable	Sports
Field	Orchard

1. Well field	6.34	10. Cow Watering Meadow (small)	2.09	21. Small Daws	3.44	31. Main Yard – Field 1	0.83	42. Stud Nursery Field	0.93
2. Barn field	6.66	11. Cow Watering Meadow (big)	3.55	22. Small Daws (trackside)	2.27	32. Main Yard – DIY 1	0.24	43. Stud – Field 1	0.94
3. Big Hook	5.61	12. Pig Meadow (west)	0.43	23. Stonebond	2.78	33. Main Yard – DIY 2	0.21	44. Stud – Field 2	0.84
4. Fruit Farm	3.36	13. Pig Meadow (east)	1.06	24. Big Daws	5.36	34. Main Yard – Field 3	0.54	45. Stud – Field 3	0.86
5. Claypitts	2.82	14. Barn Field (west)	0.66	25. Stoneyshotts	3.72	35. Main Yard – Field 4	0.89	46. Stud – Field 4	1.12
6. Barn Field (BP)	2.35	15. Joyce Field	2.59	26. Long Meadow	1.57	36. Main Yard – Field 5	0.85	47. Stud – Field 5	0.43
7. Foxburrows	14.78	16. Small Reservoir	2.47	27. Stable Field	1.33	37. Main Yard – Field 6	1.76	48. Stud – Field 6	0.58
8. Butt Field	3.86	17. Weaning Paddock (farm)	0.82	28. Lawford Lane	4.94	38. Main Yard – Field 7	1.17	49. Stud – Field 7	0.42
9. Rugby Field	5.22	18. Victoria	3.60	29. Loampits	1.80	39. Main Yard – Field 8	0.87	50. Stud Victoria	2.29
		19. Horse Paddock (quarry)	3.33	30. Genus Site	3.75	40. Park 1	0.72	51. Stud – Weaning Paddock 1	0.66
		20. Horse Paddock	2.41			41. Park 2	1.07	52. Stud – Weaning Paddock 2	0.67
								53. Sports Fields	7.53
								54. Orchard	2.27

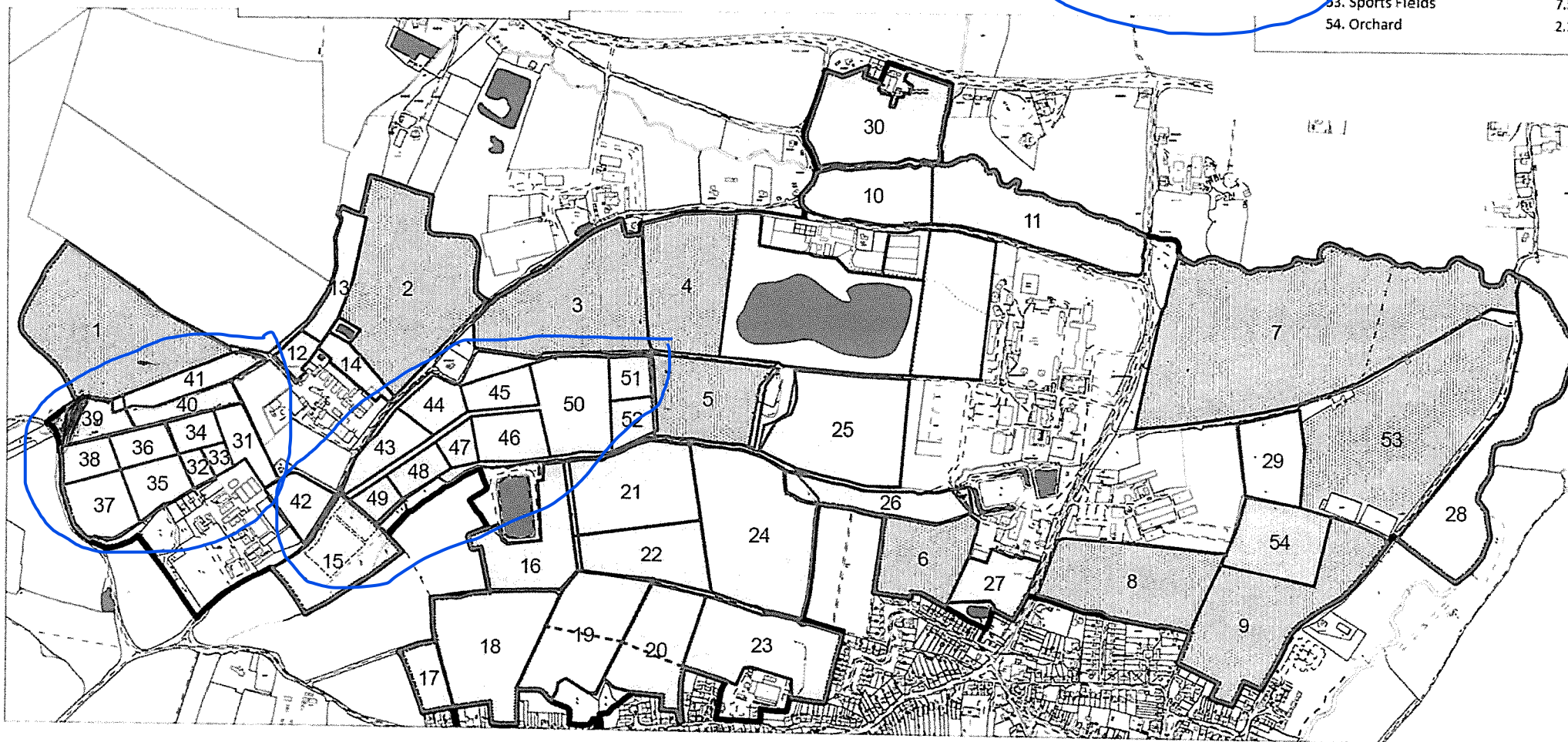
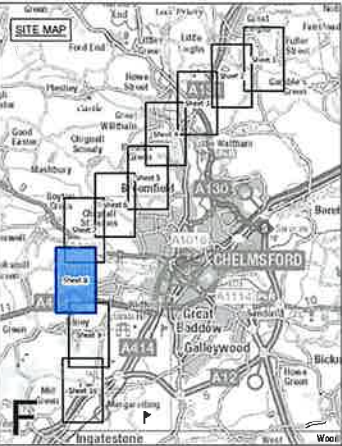


EXHIBIT CF1/2



THE NATIONAL GRID (NORWICH TO TILBURY) ORDER
WORKS PLANS
REGULATION 5(2)(j)
SECTION F (SHEET 8 OF 10,
CHELMSFORD CITY COUNCIL)

Application Document 2.3



- Legend**
- Local authority boundary
 - Section boundary & local authority boundary
 - Section boundary
 - Sheet index cutlines
 - Commencement of work
 - Termination of work
 - Order Limits
 - Limits of deviation: overhead lines
 - Limits of deviation: underground cables
 - Limits of deviation: non-linear works
 - Proposed lattice pylons (not to scale)
 - Proposed low height lattice pylons (not to scale)
 - Proposed pylon removal (not to scale)
 - Proposed pylon modification (not to scale)
 - Proposed temporary pylon (angle structures only) (not to scale)
 - Proposed overhead line
 - Third party overhead line to be removed
 - Third party existing overhead line (modified)
 - Third party temporary overhead line diversion
 - Third party proposed underground cable centreline

FOR CONTINUATION SEE SHEET 7

CENTRELINE OF
WORK No. 17

Writtle

Little Oxney
Green

- Notes**
- These plans show the Order Limits and potential location for the works. Due to the need for future flexibility, National Grid will be applying for Order Limits and Limits of Deviation within its Development Consent Order, within which any final alignments would lie.
 - For additional detail on the plan suites, please refer to the Guide to Plans (document reference 2.0), located in the Volume 2 of the DCO application.
 - This drawing is scaled at paper size A0, therefore any prints taken at smaller sizes will affect accuracy of the measurement units and should not be scaled against.

Coordinate System: British National Grid
Sheet X Central Coordinate: 565244 Sheet Y Central Coordinate: 206431



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Revision History				
No.	Date	Description	By	For
1	2023-08-01	Issue for DCO submission	MAB	JPC
2	2023-08-01	Issue for DCO submission	MAB	JPC
3	2023-08-01	Issue for DCO submission	MAB	JPC
4	2023-08-01	Issue for DCO submission	MAB	JPC
5	2023-08-01	Issue for DCO submission	MAB	JPC
6	2023-08-01	Issue for DCO submission	MAB	JPC
7	2023-08-01	Issue for DCO submission	MAB	JPC
8	2023-08-01	Issue for DCO submission	MAB	JPC
9	2023-08-01	Issue for DCO submission	MAB	JPC
10	2023-08-01	Issue for DCO submission	MAB	JPC

Issue	Date	Remarks	Drawn	Checked	Approved
A	AUG-2023	For DCO submission	MAB	JPC	KR

Title

THE NATIONAL GRID
(NORWICH TO TILBURY) ORDER
WORKS PLANS
REGULATION 5(2)(j)
SECTION F (SHEET 8 OF 10,
CHELMSFORD CITY COUNCIL)

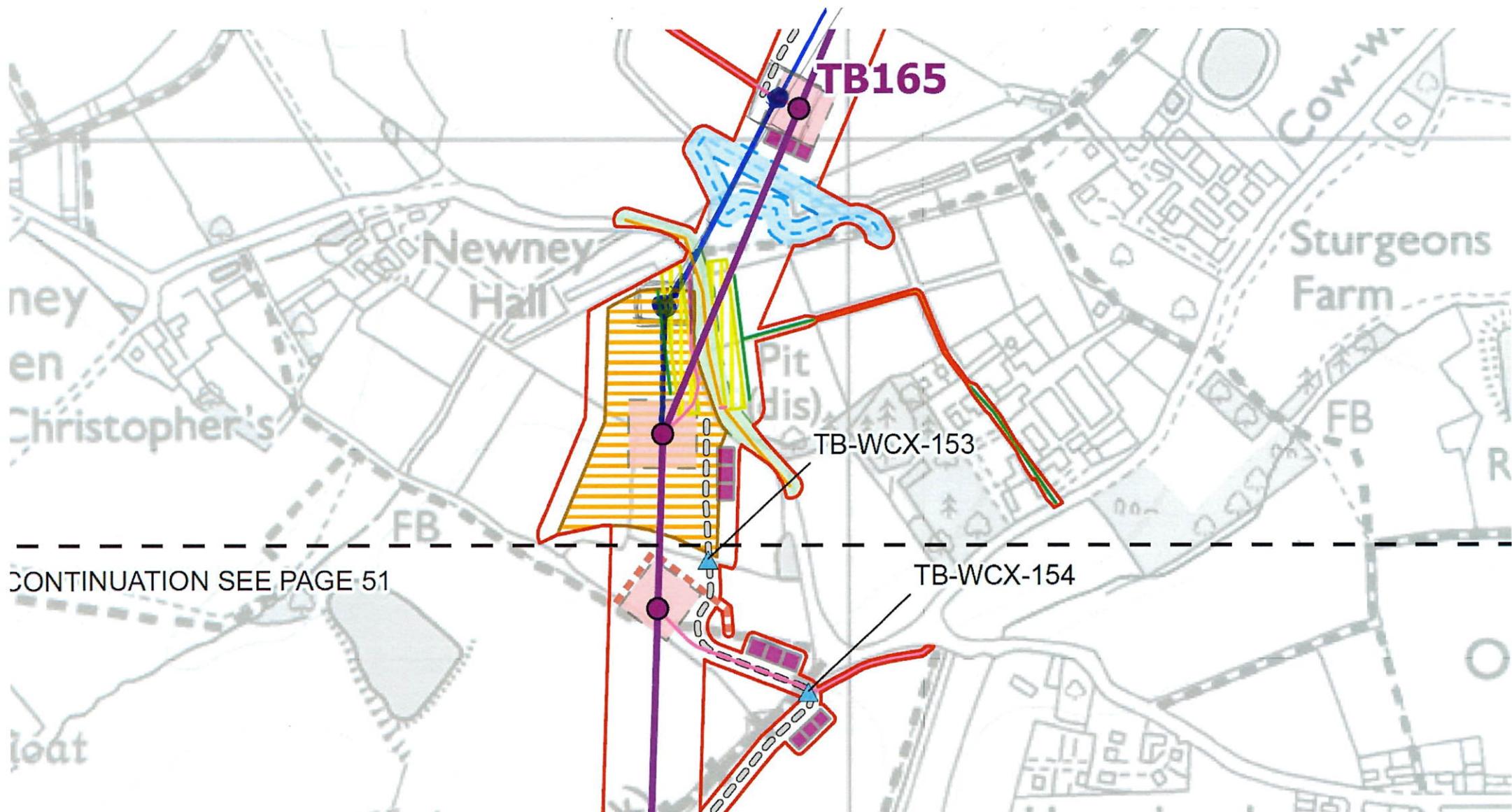
nationalgrid

PINS Application Number
EN020027

National Grid Drawing Reference
AENC-LSTC-ENG-DWG-0003

Scale	Sheet Size	Sheet	Issue
1:2,500	A0	SHEET 8 OF 10	A

EXHIBIT CF1/3



N-T PROJECT - ARU WRITTLE
ARU Writtle Overhead Electrical Line Micro-siting Plan

EXHIBIT CF1/4

Writtle University College Estate: Fields

Arable	Sports
Field	Orchard

1. Well field	6.34	10. Cow Watering Meadow (small)	2.09	21. Small Daws	3.44	31. Main Yard – Field 1	0.83	42. Stud Nursery Field	0.93
2. Barn field	6.66	11. Cow Watering Meadow (big)	3.55	22. Small Daws (trackside)	2.27	32. Main Yard – DIY 1	0.24	43. Stud – Field 1	0.94
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								53. Sports Fields	7.53
								54. Orchard	2.27

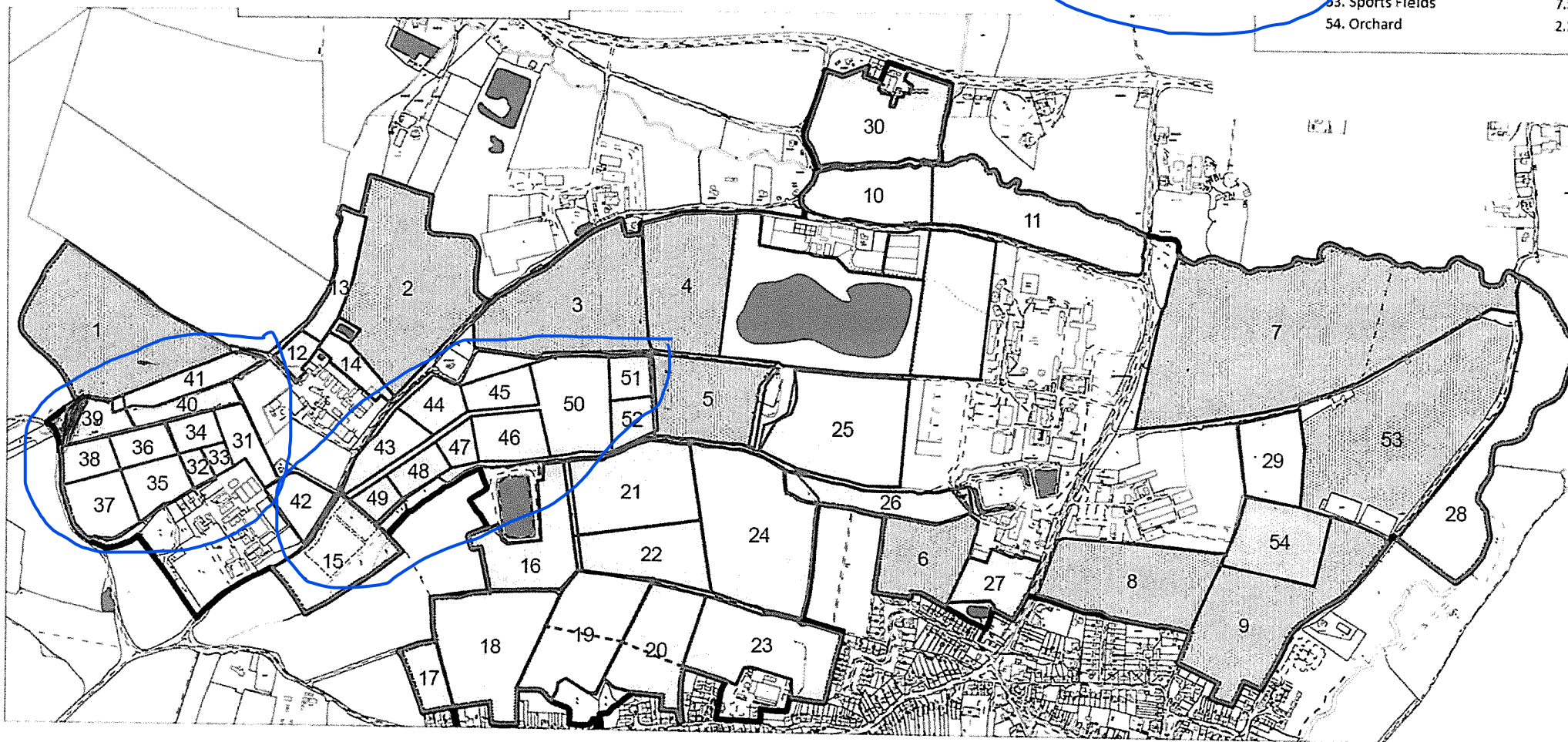
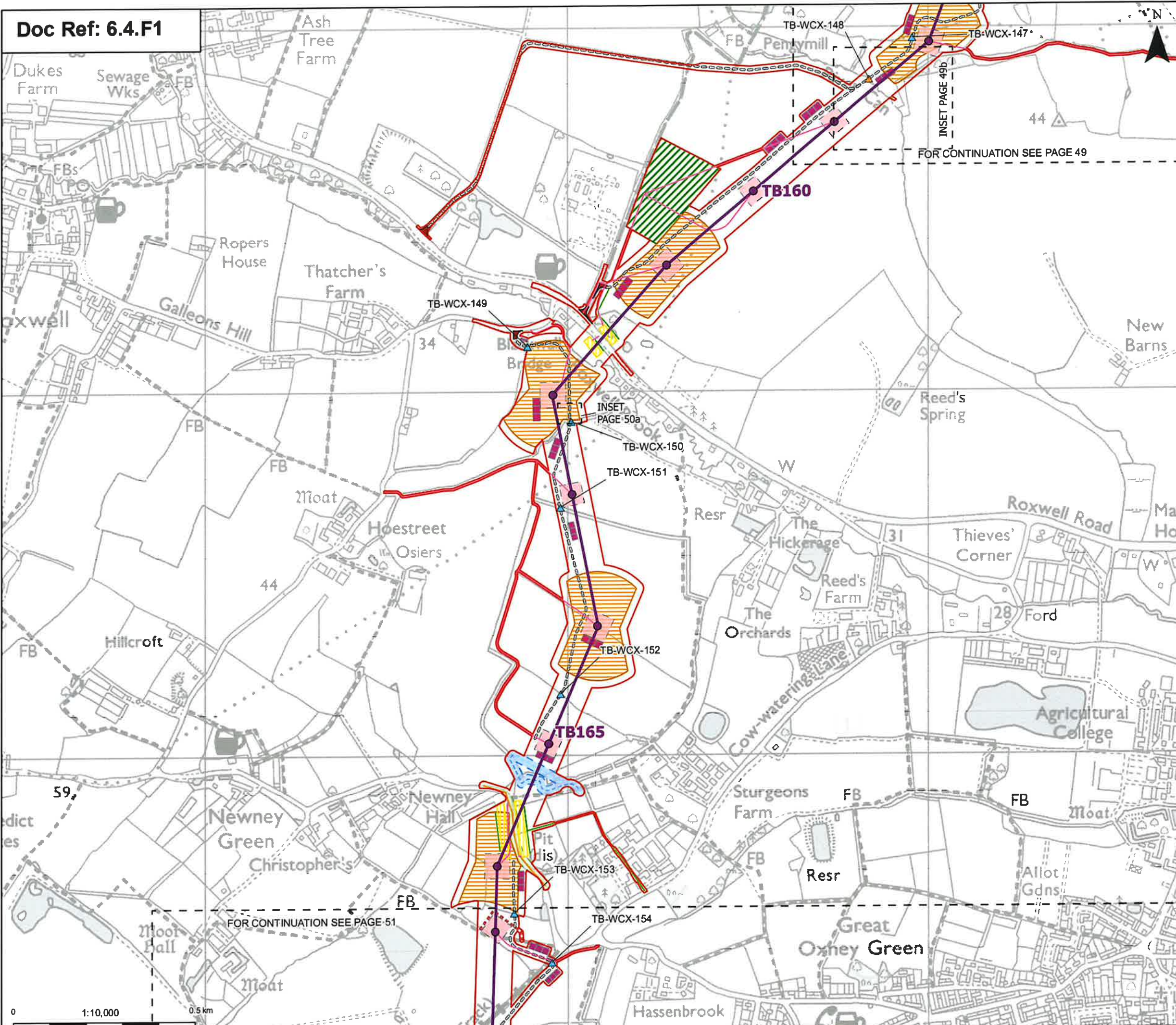


EXHIBIT CF1/5



- Order Limits
- Sheet index outline
- Proposed permanent design details
 - Proposed standard lattice pylon location
 - Proposed overhead line alignment
 - Proposed permanent access (no physical works)
 - Proposed BT overhead line mitigation
 - Proposed 11kV overhead line mitigation
 - Proposed 11kV underground cable alignment mitigation
- Proposed temporary design details
 - Proposed construction laydown areas
 - Proposed overhead line construction SUDS basin
 - Proposed site access point
 - Proposed temporary haul road
 - Proposed overhead line crossing protection access route
 - Proposed overhead line crossing protection work area
 - Proposed pylon construction work area
 - Proposed overhead line pulling location
 - Proposed UKPN overhead line mitigation work area (wood pole line)
 - Proposed BT overhead line mitigation work area
 - Proposed PRow diversions
 - Proposed Environmental Mitigation Areas - Temporary
 - Proposed overhead line access watercourse crossing - culvert
 - Proposed overhead line access watercourse crossing - bridge
- Note: The proposed overhead line alignment and proposed underground cable alignment together comprise the alignment.

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Rev	Date	Description	Drawn	Check	Approv
A	Aug 2025	FOR DCO APPLICATION	KF	AF	KB

PROJECT: **nationalgrid** Norwich to Tilbury

Planning Inspectorate App Number: EN020027 Regulation 5(2)(a)

Title: **Figure 4.1 - Project Description - Proposed Project Design Section F**
Page 50 of 63

Designed	A. Fell	Date	21 Aug 25
Drawn	K. Fischer	Date	21 Aug 25
Checked	A. Fell	Date	21 Aug 25
Approved	K. Burrows	Date	21 Aug 25
Scale:	1:10,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	A2	Project Number:	10059280

Suitability Description: Accepted as Concept Stage

Drawing Number:	10059280-ARC-EGN-ZZ-DR-ZZ-00206	Revision:	A
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EXHIBIT CF1/6

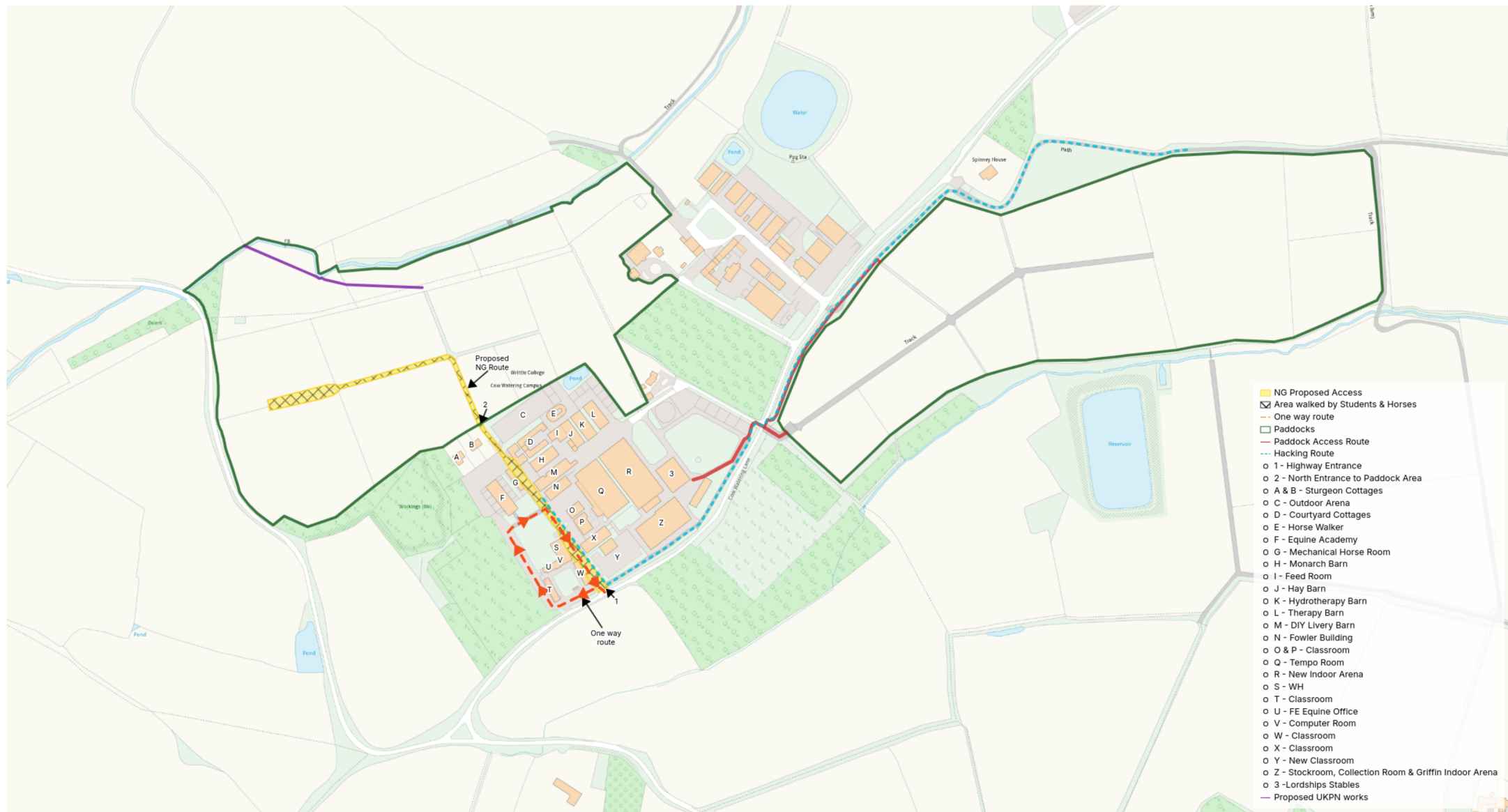
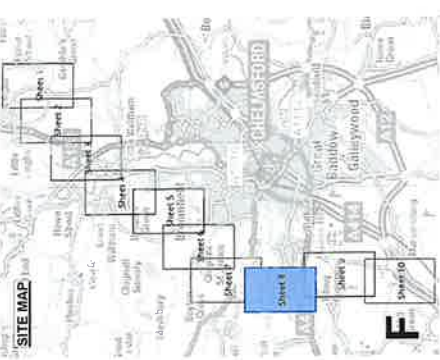


EXHIBIT CF1/7



THE NATIONAL GRID (NORWICH TO TILBURY) ORDER
LAND PLANS
REGULATION 5(2)(i)-(iii)
SECTION F (SHEET 8 OF 10,
CHELMSFORD CITY COUNCIL)

Application Document 2.2



Legend

- Local authority boundary
- Section boundary & local authority boundary
- Section boundary
- Sheet index outlines
- Order Limits
- Class 1 - Compulsory acquisition of land
- Class 2 - Compulsory acquisition of rights - Overhead line
- Class 3 - Compulsory acquisition of rights - Underground cable system
- Class 4 - Compulsory acquisition of rights - Overhead line and underground cable system
- Class 5 - Compulsory acquisition of rights - Access
- Class 6 - Compulsory acquisition of rights - Drainage
- Class 7 - Temporary use
- Class 8 - Land not subject to powers of acquisition nor temporary use

FOR CONTINUATION SEE SHEET 7

FOR CONTINUATION SEE SHEET 9

Notes
1 For additional detail on the plan scales, please refer to the Guide to Plans (document reference 2.0), located in the Volume 2 of the DCO application
2 This drawing is scaled at paper size A0, therefore any points taken at smaller sizes will affect accuracy of the measurement units and should not be scaled against.

Coordinate System: British National Grid
Sheet 8: Chelmsford City Council
Sheet 8: Chelmsford City Council
Sheet 8: Chelmsford City Council

BACKGROUND MAP INFORMATION HAS BEEN REPRODUCED FROM THE NATIONAL GRID (NORWICH TO TILBURY) ORDER, REGULATION 5(2)(i)-(iii), SECTION F (SHEET 8 OF 10, CHELMSFORD CITY COUNCIL). THE NATIONAL GRID (NORWICH TO TILBURY) ORDER, REGULATION 5(2)(i)-(iii), SECTION F (SHEET 8 OF 10, CHELMSFORD CITY COUNCIL).

THE NATIONAL GRID
(NORWICH TO TILBURY) ORDER
LAND PLANS
REGULATION 5(2)(i)-(iii)
SECTION F (SHEET 8 OF 10,
CHELMSFORD CITY COUNCIL)

nationalgrid

PLUS Application Number		EN020027	
National Grid Drawing Reference		AENC-TOST-LAN-DWG-0002	
Scale	Sheet Size	Sheet	Issue
1:2500	A0	SHEET 8 of 10	A

EXHIBIT CF1/8



THE NATIONAL GRID (NORMICH TO TILBURY) ORDER
TRAFFIC REGULATION ORDER PLANS
REGULATION 5(2)(o)
SECTION F (SHEET 8 OF 10,
CHELMSFORD CITY COUNCIL)

Application Document 2.4



- Legend**
- Local authority boundary
 - Section boundary & local authority boundary
 - Section boundary
 - Sheet index culines
 - Order Limits
 - Street Works
 - Street management: start/end point of traffic regulation order
 - Street management: Temporary traffic regulation order
 - Example reference for traffic regulation order

FOR CONTINUATION SEE SHEET 7

Newney Green

Cow Watering Lane

Writtle

Little Oxney Green

Highwood Road

A414 Orsett Road West

Ladygrove

The Causeway

FOR CONTINUATION SEE SHEET 9

Notes

- These plans show the Order Limits and potential location for the works. On the day of the works, the Order Limits will be marked on the ground by the Order Limits and Limits of Deviation within the Development Consent Order, within which any final alignment would lie.
- For additional detail on the plan, please refer to the Guide to the Development Consent Order (DCO) located in the Volume 2 of the DCO application.
- This drawing is scaled at paper size A0. Therefore any points taken at scale will not be scaled again.
- These plans should be read in conjunction with Parts 1 to 4 of Schedule 15 (Traffic Regulation Orders) of the Development Consent Order.

Coordinate System: British National Grid
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Issue	Date	Remarks	Drawn	Checked	Approved
A	AUG-2023	For DCO submission	MC	ST	NR

Title

THE NATIONAL GRID
(NORMICH TO TILBURY) ORDER
TRAFFIC REGULATION ORDER PLANS
REGULATION 5(2)(o)
SECTION F (SHEET 8 OF 10,
CHELMSFORD CITY COUNCIL)

nationalgrid

PINS Registration Number: ENG000027

National Grid Drawing Reference: AENC-AMAC-ENG-DWG-0083

Scale: 1:2,500
Sheet Size: A0
Sheet 8 of 10
Issue: A

EXHIBIT CF1/9

**APPLICATION BY NATIONAL GRID ELECTRICITY TRANSMISSION PLC
FOR
A DEVELOPMENT CONSENT ORDER
PURSUANT TO SECTION 37 PLANNING ACT 2008
FOR
THE NORWICH TO TILBURY ELECTRIC LINE ABOVE GROUND**

PLANNING INSPECTORATE REFERENCE: EN020027

THIRD WITNESS STATEMENT

JANE KENNY

On behalf:

Interested Party Reference Number: NTOT-AFP2247 and F1201D06F

1. BACKGROUND AND QUALIFICATION

- 1.1 My name is Jane Kenny MRICS FAAV FALA.
- 1.2 I am a qualified Chartered Rural Surveyor with in-excess of 20 years of property experience.
- 1.3 I am a Director at Savills, head of consultancy for the eastern region. I specialise in advising landowners affected by a range of different infrastructure projects from National Significant Infrastructure Projects to smaller local schemes. I have been advising ARU Writtle since 2023 in relation the Applicant's Norwich-Tilbury Project.
- 1.4 The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true. Where I refer to information supplied by others, the source of the information is identified; facts and matters derived from other sources are true to the best of my knowledge and belief.
- 1.5 There is now produced and shown to me a bundle of true copy documents marked "Exhibit JK1". All references to documents in this statement are to Exhibit JK1 unless otherwise stated. References to tab numbers in this statement are to the respective tabs in Exhibit JK1 in the format JK1/[x]

2. INTRODUCTION

- 2.1 This Third Witness Statement provides a further update in relation to ARU Writtle's objection to the proposed overhead electricity cables passing over ARU Writtle land.

- 2.2 As set out in the ARU Deadline 4 Submission, National Grid (“NGET”) confirmed with us at a meeting held on 15 April 2026 that the routing of the overhead cables across ARU Writtle land was under review by their design team. To date, 7 July 2026, no further update or response has been provided by NGET on this matter. Given that NGET first applied for its draft development consent order on the 29 August 2025, and the statutory Examination Hearing Period concludes on the 10 August 2026, this slothful progress is surprising.
- 2.3 Given also that NGET is seeking a “Rochdale Envelope” type consent that would enable the detail of its project to be worked out inside of the terms of parameters stated in the draft development consent order, and on its proposed certified plans, the slothful approach of NGET remains inexplicable for a national and nationally resourced organisation that also asserts there to be much new urgency for its project.

3. MICROSITING

- 3.1 Article 3(1) of the draft development consent order would authorise NGET to install the electric lines and pylons and Article 5(1)(a) would entitle NGET to situate the electric lines anywhere “within the limits of deviation” “relating to a Work shown on [the works] plans and carry out construction activities for the purpose of the authorised development anywhere within the Order Limits”. The Works Plans, Section F, Sheet 8, show the red-outlined area of the Order Limits in the vicinity of ARU Writtle and an orange dashed line shows the Westernmost and Easternmost outer edges of the limits of deviation that are centred on an axis at the midpoint of the red-outlined corridor forming the ground level of the “Rochdale Envelope” box inside of which the pylons would be situated somewhere with the electric lines suspended between them. The Lands Plans, Section F, Sheet 8, show the overlap of the Order Limits with the Western part of the ARU Writtle Educational Establishment that includes school education for students aged 16 and upwards.
- 3.2 The Order Limits through ARU Writtle land do not define nor determine in their interior the actual location of any pylon nor electrical line inside the extent of the Limits. Instead, the Works Plan referred to shows only a notional axis of a purple line of the envisaged route of the new electrical line. If that were not so, then the proposed Article 5(1) limits of deviation and their actual range would be otiose. Therefore, the currently proposed alignment of the overhead line, including the location of pylons can only be regarded as notional. The notional line is shown by reference to the Environmental Statement Document Reference 6.4.F1, Section F, page 50 of 63. See plan attached at Exhibit JK1/1. On the basis of the Article 5(1) limits of deviation, this shows the Works Plan to relate to Plots 8/15, 8/20, 8/19, 8/21, 8/23, 8/24, 8/25, 8/27, 8/28, 8/29, 8/37, 8/38, 8/39, 8/45 if the notional axis were fixed (and Article 5(1) were absent). But, Article 5(1) forms part of the draft development consent order sought by

NGET and so the draft Order evidences and contains actual latitude to the West and to the East in relation to the ARU Writtle Land. The proposed power for NGET under Article 5(1) proposes a discretion also and this too evidences further actual latitude to the West and to the East in relation to the ARU Writtle Land.

- 3.3 For the reasons set out in this Witness Statement and others provided on ARU's behalf, ARU Writtle need the overhead line to be located as far west as possible within the red line boundary and the Order Limits, so as to avoid or significantly reduce the actual microshocking of horses (in its herd of 90 horses) during their use of the Western paddocks forming part of the ARU Writtle Equine Facility school, and related foreseeable harm to both horses and students and staff in that location, that would result permanently in relation to the land of ARU Writtle if the Order Limits remain undefined in that location.
- 3.4 Because of the terms of Article 5(1) of the draft development consent order, it is evident that NGET could situate individual pylons, and the resulting alignment of overhead electric cables between those then fixed points, anywhere inside of the Order Limits, including along the extreme Western or extreme Eastern edge of the Order Limits. Therefore, there are numerous locations where the pylons in the vicinity of ARU Writtle (between TB 162, 163, 164, 165, and 166 inclusive) could be situated so as to produce an alignment of the proposed overhead electrical cable to the West of ARU Writtle Land whilst simultaneously remaining inside the parameter of the Article 5(1) limits of deviation. It is clear to me that NGET remains since the application was first made on 29 August 2025 actually able to route the straight line of the overhead line between pylons such that that new line would not pass over ARU Writtle land.
- 3.5 By way of example, I have produced a route of the overhead electrical cable spanning between pylons reference TB 166 and TB 165 that is shown in dark blue line on the attached plan Exhibit JK1/2, the ARU Writtle Overhead Electrical Line Micro-siting Plan. The route of the cable in dark blue is secured by no more than locating TB 166 slightly further to the North of its notional location inside the Order Limits, and, if needs be also, locating pylons TB 165 (and potentially TB164) further Westwards also inside of the Article 5(1) limits of deviation.
- 3.6 When one compares the line of the overhead cable in the ARU Writtle Overhead Electrical Line Micro-siting Plan coloured dark blue, with the plan that I produced with my Second Witness Statement, it can be seen that the dark blue coloured line passes to the West of the North-Westernmost paddock comprising part of the ARU Writtle Educational Establishment and across a small clump of trees. I note that NGET has envisaged in its Response to ARU Writtle raising the line and so there can be no issue in respect of avoiding the trees. I further note that Article 3(1) and Schedule 1, Associated Development, would authorise NGET on the basis of any necessary or

expedient associated development, under paragraph (i) to plant “trees, hedgerows and vegetation”. Therefore, the oversailing of trees presents no practical issue for NGET.

3.7 Of course, all of these matters are also inside the Order Limits and because the exterior of the notional box of the “Rochdale Envelope” has already been subject to environmental impact assessment, there can be no conceivable difference in respect of the impacts of micro-siting those particular pylons to ensure that no new overhead lines pass over ARU Writtle paddock areas that would foreseeably contain horses and students being taught in that Educational Establishment. Whilst NGET may resist such micro-siting, I would suggest that such NGET resistance could only distil to reticence by draftsmen (who equally have indicated a reluctance to merely delete the yellow colour from Plot 8/42 (on the 24 June 2026) and refuse to go so far as to delete the red lines on the relevant electronic layers of the autocad-type drawings that will in due course comprise the certified plans.

3.8 Given that NGET progress in relation to ARU Writtle’s real concerns has been slothful at best and nearly a year has passed since its application was made on 29 August 2025, a Requirement remains evidently necessary to ensure the protection of the Educational Establishment land of ARU Writtle and this would be in line with the Department for Energy and Climate Change guidance on microshocks from new overhead electrical lines envisaged in relation to schools.

4. **ANIMAL WELFARE AND SAFETY CONCERNS**

4.1 The requirement to avoid overhead lines crossing ARU Writtle paddock land arises primarily from animal welfare and safety concerns, specifically relating to the effects of micro electric shocks on horses. ARU Writtle has evidenced the effects of microshocks on horses and resulting safety and foreseeable harms to students and staff in its sworn evidence before the ExA and the Secretary of State.

4.2 Horses are highly sensitive, flight-oriented animals. If subjected to any form of electric shock, their reaction can be sudden and unpredictable. Typical responses may include:

4.2.1 Sudden jumping or leaping away

4.2.2 Rapid backward movement

4.2.3 Throwing the head upwards

4.2.4 Whole body reactions such as shaking

4.2.5 Snorting and spooking behaviour.

These reactions present significant risks, both to the animals themselves and to individuals nearby.

- 4.3 The risks are heightened due to the nature of ARU Writtle as an educational facility, where students (including those aged 16 and upwards) may be handling horses or in close proximity during routine activities. Any such incident could result in serious injury. The potential consequences of these reactions cannot be underestimated.
- 4.4 Accordingly, it is essential and necessary to minimise the risk of micro shocks affecting horses grazing beneath or near the proposed overhead line corridor. A Requirement ensuring no overhead electric line passes over an ARU Writtle paddock land area would ensure the ongoing safe use of the paddocks by horses, students and staff, as they do presently.

5. **ENGAGEMENT WITH UK POWER NETWORK (“UKPN”)**

- 5.1 Article 3(1) and (3) of the proposed development consent order by NGET includes proposed authorisation for the third party “UKPN”. Article 2(1) defines “UKPN” as two legal entities: “UK Power Networks Holdings Limited” and “Eastern Power Networks plc”. By its proposed Article 24(2), NGET proposes that a third party – UKPN – would be entitled to compulsorily acquire land (including that of ARU Writtle) under Article 25(1). There are no specific Works in Schedule 1 that apply to ARU Writtle land in respect of UKPN works. Instead, “Associated Development” appears under paragraph (f) to provide for the installation” of “electric line”.
- 5.2 ARU Writtle heard nothing from UKPN before the 29 August 2025, nor after that date nor until late March 2026 when it received a letter from UKPN about the project. Following ARU Writtle’s Deadline 4 submission, I noted that a first and *introductory* (only) meeting was held via Microsoft Teams on 23 April 2026 with Dalcour Maclaren, acting as agents on behalf of “UKPN”, in respect of third-party works.
- 5.3 This introductory meeting included representation from Dalcour Maclaren (Jack Cook and Dexter Myres) for UKPN, and Savills (David Jones and myself) for ARU Writtle.
- 5.4 At the meeting the operational and functional nature of ARU Writtle as an Educational Establishment was explained to UKPN together with ARU concerns regarding the proposed works by UKPN in relation to the Northernmost paddock areas of the establishment associated with the Norwich to Tilbury overhead line between pylon references TB165 and TB166. In particular, animal welfare and student safety and operational safety were discussed.
- 5.5 The following matters were discussed in general terms:

- 5.5.1 Measures necessary to minimise disruption to grazing ground surfaces and operations
- 5.5.2 Construction methodologies, including open cut versus horizontal directional drilling (HDD) (identified as the necessary option to avoid paddock ground surface disruption)
- 5.5.3 The potential to re-route cables around the field instead of crossing it should open cut be adopted
- 5.5.4 Fencing of the works until land is safe to be brought back into use
- 5.5.5 Loss of grazing land during construction
- 5.5.6 Reinstatement requirements.

However, no substantive feedback or agreed position has been provided on any of these matters to date.

- 5.6 A further site meeting is currently scheduled for 16 July 2026 with representatives of UKPN and Dalcour Maclaren as well as representatives from ARU Writtle to commence discussions.

6. **ENGAGEMENT WITH NGET**

- 6.1 Aside from receiving copies of NGET's Responses to the Examining Authority, and listening to NGET in the issue specific hearings, there remains no, nor has there been further nor meaningful engagement with ARU Writtle from NGET. The absence of such engagement by NGET with ARU remains surprising and also regrettable given NGET seeks compulsory purchase powers over ARU land.

7. **SUMMARY AND CONCLUSION AS AT DEADLINE 6 (7 JULY 2026)**

- 7.1 NGET made its application for development consent on the 29 August 2025 and included in that application compulsory purchase powers including in relation to ARU land. In summary NGET has **on the 24 June 2026 affirmed to the ExA that its desired proposed access (via Plot 8/42) through ARU Writtle remains not required**. This tardy affirmation is welcome. However, NGET has recently accepted that electric shocks will occur from its new overhead power lines in relation to ARU paddocks and at the same time continues to fail to address the continued detrimental impact of the overhead cables crossing ARU Writtle land. Because the limits of deviation under Article 5(1)(a) of the NGET draft development consent order include a significant West and Eastward latitude in relation to the actual location of the pylon

locations and the electric lines between the pylons, it is possible to organise the micro-siting of pylons near to ARU Writtle so as to result in the overhead electrical line between the pylons not actually oversailing ARU's paddock land areas, but avoiding that land area and so avoiding microshocks to horses, students and staff in those areas, and resulting danger and harm to those present in that situation. (See Exhibit JK1/2 attached to this witness statement).

7.2 There remains a significant lack of information and an absence of any meaningful engagement from UKPN with ARU by which to resolve real concerns.

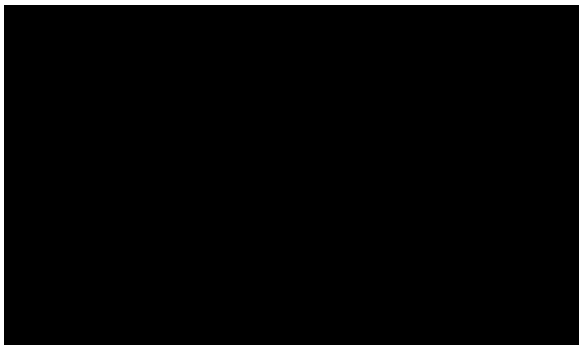
7.3 In light of the above, it is my view the proposals as currently put forward remain unjustified on the ARU Writtle Land.

Statement of Truth

I understand that proceedings for contempt of court may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief in its truth.

I believe that the facts stated in this Witness Statement are true.

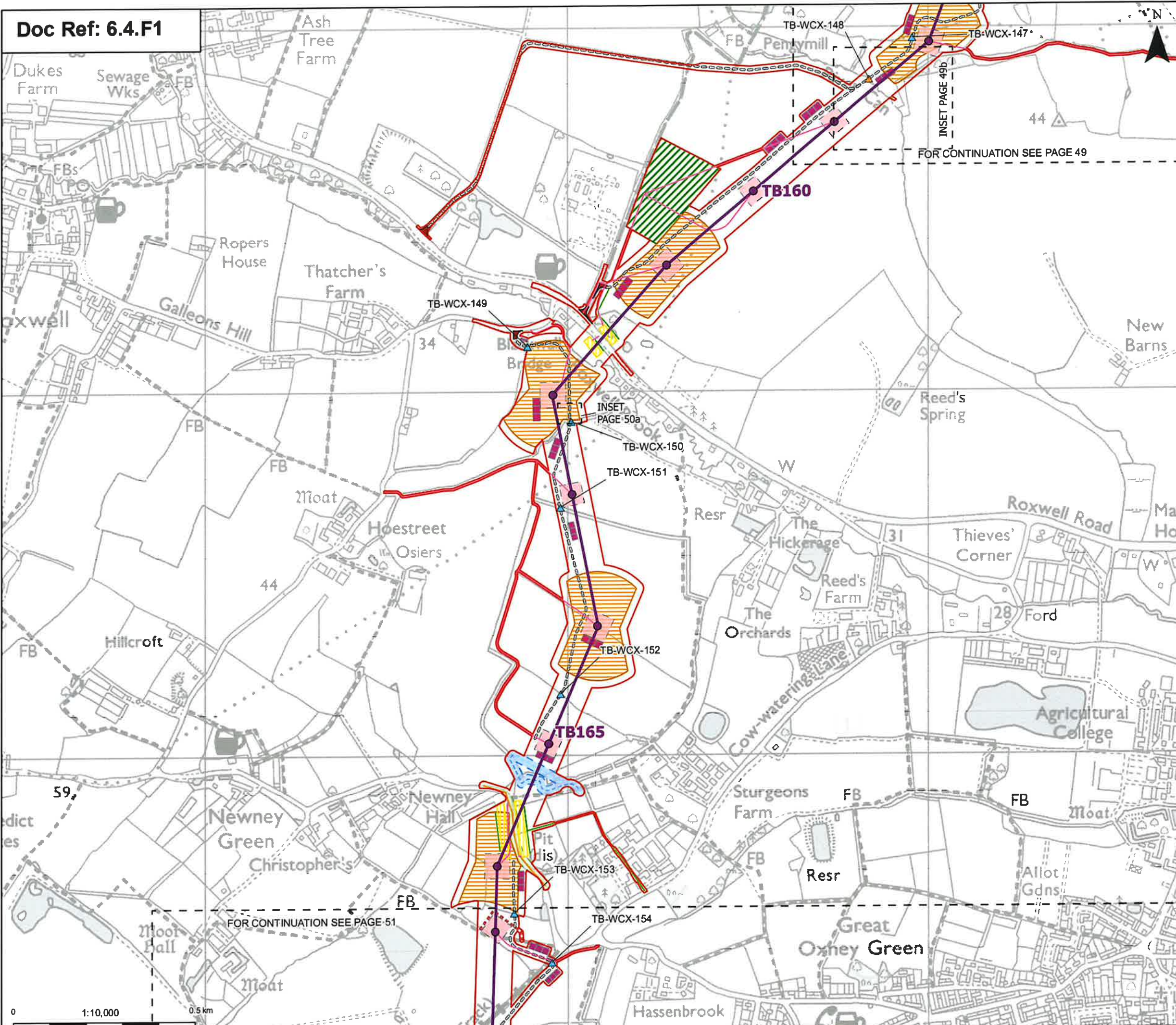
Signed

A large black rectangular box redacting the signature of the witness.

Dated 7th July 2026

.....

EXHIBIT JK1/1



- Order Limits
- Sheet index outline
- Proposed permanent design details
 - Proposed standard lattice pylon location
 - Proposed overhead line alignment
 - Proposed permanent access (no physical works)
 - Proposed BT overhead line mitigation
 - Proposed 11kV overhead line mitigation
 - Proposed 11kV underground cable alignment mitigation
- Proposed temporary design details
 - Proposed construction laydown areas
 - Proposed overhead line construction SUDS basin
 - Proposed site access point
 - Proposed temporary haul road
 - Proposed overhead line crossing protection access route
 - Proposed overhead line crossing protection work area
 - Proposed pylon construction work area
 - Proposed overhead line pulling location
 - Proposed UKPN overhead line mitigation work area (wood pole line)
 - Proposed BT overhead line mitigation work area
 - Proposed PRow diversions
 - Proposed Environmental Mitigation Areas - Temporary
 - Proposed overhead line access watercourse crossing - culvert
 - Proposed overhead line access watercourse crossing - bridge
- Note: The proposed overhead line alignment and proposed underground cable alignment together comprise the alignment.



Rev	Date	Description	Drawn	Check	Approv
A	Aug 2025	FOR DCO APPLICATION	KF	AF	KB

PROJECT:
nationalgrid Norwich to
Tilbury

Planning Inspectorate App Number: EN020027
Regulation 5(2)(a)

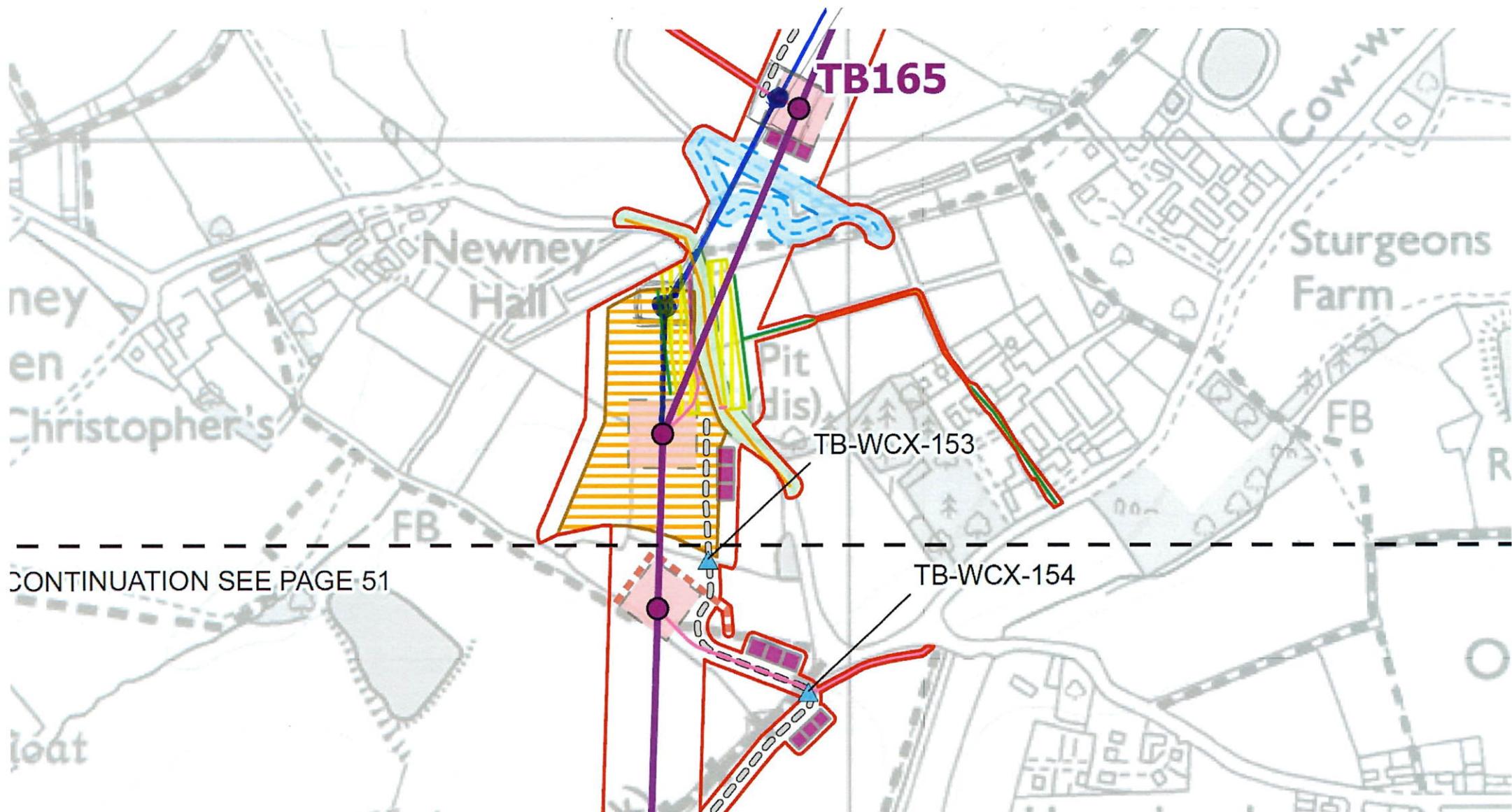
Title:
Figure 4.1 - Project Description -
Proposed Project Design
Section F
Page 50 of 63

Designed	A. Fell	Date	21 Aug 25
Drawn	K. Fischer	Date	21 Aug 25
Checked	A. Fell	Date	21 Aug 25
Approved	K. Burrows	Date	21 Aug 25
Scale:	1:10,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	A2	Project Number:	10059280

Suitability Description:
Accepted as Concept Stage

Drawing Number: 10059280-ARC-EGN-ZZ-DR-ZZ-00206	Revision: A
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EXHIBIT JK1/2



N-T PROJECT - ARU WRITTLE
ARU Writtle Overhead Electrical Line Micro-siting Plan

**APPLICATION BY NATIONAL GRID ELECTRICITY TRANSMISSION PLC
FOR
A DEVELOPMENT CONSENT ORDER
PURSUANT TO SECTION 37 PLANNING ACT 2008
FOR
THE NORWICH TO TILBURY ELECTRIC LINE ABOVE GROUND**

PLANNING INSPECTORATE REFERENCE: EN020027

SECOND WITNESS STATEMENT

MICHELLE LAWLOR-PERKINS

On behalf:

Interested Party Reference Number: NTOT-AFP2247 and F1201D06F

1. BACKGROUND AND QUALIFICATION

- 1.1 My name is Michelle Lawlor-Perkins.
- 1.2 I am Head of Legal for Anglia Ruskin University ("**ARU**"). In my role, I advise my colleagues regarding legal matters relating to ARU.
- 1.3 The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true. Where I refer to information supplied by others, the source of the information is identified; facts and matters derived from other sources are true to the best of my knowledge and belief.
- 1.4 There is now produced and shown to me a bundle of true copy documents marked "Exhibit MLP1". All references to documents in this statement are to Exhibit MLP1 unless otherwise stated. References to tab numbers in this statement are to the respective tabs in Exhibit MLP1 in the format MLP1/[x]

2. INTRODUCTION

- 2.1 This second witness statement describes ARU's engagement with Essex County Council ("**ECC**") and UKPN and the current position being taken by National Grid ("**NGET**") in respect of ARU Writtle in respect of the proposed development by NGET under the proposed NGET (Norwich To Tilbury) Order.
- 2.2 My evidence should be read with the other witness statements and evidence submitted by ARU, including my first witness statement regarding ARU's continued engagement

with NGET to raise our concerns in respect of NGET's proposal for a new proposed access road through the ARU Writtle Campus. The DCO would result in the permanent (as in, perpetual) entitlement in favour of NGET and others authorised under that DCO to pass through the Equine Centre at ARU Writtle Campus. For the reasons I and others on behalf of ARU have set out previously, this is not an appropriate, acceptable or justifiable proposition.

3. ENGAGEMENT WITH ESSEX COUNTY COUNCIL

3.1 As detailed in my first witness statement, Mark Woodger, National Strategic Infrastructure Projects Manager for ECC, attended our site visit with NGET on 4th March 2026 whereby we explained how dangerous it would be for our staff, students and animals for NGET to continue with its proposal to have a new proposed access road through the ARU Writtle Campus and whereby we showed our proposed alternative accessways.

3.2 Subsequently I met with Faye Murray, Principal Transportation & Infrastructure Planner, and Matthew Bradley, Strategic Development Manager (both of ECC), together with our Highways Consultant, Joseph Hough of KMC Transport Planning Ltd, on 29th April 2026. At this meeting, Ms Murray and Mr Bradley advised that they themselves had been requesting information from NGET so that they could assess the access situation from Newney Green but that such information had not been forthcoming from NGET.

3.3 I met again with Ms Murray and Mr Bradley together with Mr Hough at 9.30am on 24th June 2026. ECC advised that NGET have now engaged with them and that following the Deadline 4 representations of ARU and the EXA's 2nd Questions, NGET was now proposing 3 options as alternatives to the proposed development consent order providing for access to the ARU Writtle Campus from its Eastern side and through the Equine Centre as follows:

Option 1: Direct access Eastwards from Newney Green lane over the roadside verge into Western part of ARU Writtle's paddock area;

Option 2: Access from the proposed haul road to the south-west of Newney Green lane, crossing Newney Green; or

Option 3: Overhead line pulling and stringing without scaffolding.

3.4 ECC advised myself and Mr Hough that Options 1 or 2 would be their preferred options and that Option 3 appeared then to involve a road closure of up to 12 weeks. ECC said that they would confirm its opinion to either Option 1 or Option 2 to NGET.

3.5 ECC also advised that they agreed with the position of ARU in respect of ensuring safe crossing of Cow Watering Lane by means of requiring traffic management would be required in respect of the additional traffic on Cow Watering Lane during the closure of

Newney Green, as detailed further in the report of Joseph Hough as submitted to Deadline 4.

ENGAGEMENT WITH “UKPN”

- 3.6 I note that “UKPN” is referred to in the draft Development Consent Order as being two legal entities. In this witness statement, when I refer to “UKPN”. I refer exclusively to “Eastern Power Networks plc” as the entity licensed by OfGem to distribute electricity locally whereas I understand that OfGem has not authorised “UK Power Networks Holdings Limited” to so distribute electricity.
- 3.7 I note that NGET included in its draft Development Consent Order provisions under Article 25 for “UKPN” to compulsorily acquire land below the paddock area of ARU Writtle. There was before that date no actual engagement by UKPN with ARU Writtle whatsoever before the inclusion of those proposed compulsory acquisition powers.
- 3.8 As is described below, it appears that neither NGET nor UKPN had actually agreed matters relating to the proposed Development Consent Order, and that both knew that to be the position on 29th August 2025 when NGET applied for its draft Order - because senior counsel for UKPN for the first time on the 24th June 2026 evidenced to the ExA (and Secretary of State) that agreement enabling UKPN to proceed at all was only reached in November 2025 (i.e. 3 months after the Order application was actually made).
- 3.9 At the CAH 3 on 24th June 2026, UKPN made it absolutely clear to all attendances at that Issue Specific Hearing that UKPN was not at that date *actually seeking* powers of compulsory acquisition but instead was seeking a dialogue with each affected person *before* UKPN decided whether or not to advance to compulsory acquisition. As UKPN explained to all, that was its own procedure and that procedure was different to that followed by NGET. I note in that latter respect that NGET failed to have any meaningful dialogue with ARU Writtle *before* it made its application for its Order on the 29th August 2025 but nevertheless included compulsory purchase provisions in respect of NGET and also UKPN (including “UK Power Networks Holdings Limited” and notwithstanding that that party is not authorised to distribute electricity by OfGem and the prohibitions of section 4 of the Electricity Act 1989). It is inexplicable how the draft Order came to include, as part of the application for the Order, compulsory acquisition provisions given the above and in particular given the absence of agreement by UKPN to the same actually known then by both NGET and UKPN and to the statutory prohibitions of section 4 as above.
- 3.10 Further, I draw the attention of the ExA (and remind, with respect, the Secretary of State), that Parliament has endorsed under section 5 of the Planning Act 2008, NPS EN-5 (2023) that provides:

2.6.3 As a last resort, where it does not succeed in reaching the agreement that it requires, the network company may, as part of its application to the Secretary of State, seek to acquire rights compulsorily over the land in question by means of a provision in the DCO.

3.11 The more recent NPS EN-5 provides the same terms in the current NPS.

3.12 I also draw attention to the relevant Guidance issued by the Department for Communities and Local Government “Planning Act 2008: Guidance related to procedures for the compulsory acquisition of land (September 2013)” that remains current and provides:

16. There may be circumstances where the Secretary of State could reasonably justify granting development consent for a project, but decide against including in an order the provisions authorising the compulsory acquisition of the land.

3.13 Paragraph 2.6.3 of NPS EN-5 and the actual circumstances of the evidence of absent of actual engagement or any meaningful engagement by either NGET or UKPN with ARU Writtle in relation to its concerns before the Order application was made by NGET in late August 2025, nor until Spring 2026 by either party. Further, as I describe below, the senior counsel for UKPN evidenced on the 24th June 2026 for the first time that UKPN itself was at that date not yet in a position to know whether it needed compulsory purchase powers.

3.14 That is, as at Deadline 6, 7th July 2026, UKPN itself remains actually not in a position to decisively conclude there is an actual need for acquisition powers by it in this draft Order. Thereby, the evidence of a putative acquiring authority shows that it was prematurely included as such by NGET in its draft development consent order. Noting that neither ARU, nor the ExA nor the Secretary of State can be in a better position than that party, and that that party itself actually does not know at this time whether or not it needs compulsory acquisition powers, and that NGET also included powers as a first and not a last resort, I myself on behalf of ARU struggle to see how: the EXA and SoS can be in a better evidenced position than the putative acquiring authority UKPN itself; on the foregoing evidence, the inclusion of compulsory purchase powers can be said to have been included lawfully “as part of its application” by NGET as a “last resort” in the face of Parliament itself requiring in NPS EN-5 (currently and previously) such powers to be the last and not the first resort.

3.15 I agree with and direct the attention of the ExA to the Secretary of State’s Guidance (September 2013), paragraph 16, that this is one of those particular occasions where the consenting Secretary of State could reasonably justify granting consent for the project simultaneously with excising the powers of any compulsory purchase acquisition in respect of ARU Writtle Land. The evidence shows that the Secretary of State could reasonably (as, on the current evidence) conclude the exclusion of such powers. I am advised and understand that the common law requires that conclusion including because: the evidence together shows ambivalence and ambiguity about whether

acquisition powers by UKPN are actually necessary as well as not having been shown to be the remedy of last resort by NGET. I request that the ExA make that recommendation to the consenting Secretary of State that a micro-siting protective provision (else a requirement) be imposed in the proposed order to ensure the non-application of Part V powers by NGET and by UKPN to ARU plots.

- 3.16 This result would not appear to prevent the project from otherwise proceeding in locations away from ARU Writtle and instead would provide NGET and the licensed UKPN with additional time (which both evidently need) in which to agree terms with ARU. Indeed, in the event that the ExA recommends (and the Secretary of State agrees) with the Requirements proposed by ARU in our Deadline 6 sworn evidence (and preceding evidence), the absence of compulsory purchase powers may make little practical difference since NGET would have sufficient powers to construct its project to the West of ARU Writtle Land and no doubt outstanding matters could be agreed with increased time then available to NGET and to UKPN. If either NGET or UKPN refused to enable the ongoing safe operation of ARU Writtle, and to agree terms, then NGET could apply at that future date for an Order for compulsory purchase powers related to its then made Order but as a then actual “last resort” or apparently under section 153 and Schedule 6, paragraphs 3(4) and 4.
- 3.17 As matters currently stand, there has been one introductory meeting between our representative, Jane Kenny of Savills acting on behalf of a number of land owners including ARU Writtle with Dalcour Maclaren, agents for UKPN. The details of this meeting are as set out at paragraphs 5.2 to 5.5 of the third witness for Jane Kenny. Since then there remain no meetings to date of 7th July 2026 advanced by UKPN. Instead, UKPN has agreed to our request for a meeting on 16th July 2026 (only a few weeks before the Examination of the Application DCO concludes on the 10th August 2026).
- 3.18 Mr Woodger will also be attending our scheduled meeting with UKPN on 16th July 2026, as detailed further at paragraph 4.3 below.

4. HEARING ON 24TH JUNE 2026

- 4.1 Following the 9.30am meeting between ARU and ECC to which I have referred above, later that morning at t the CAH 3 issue specific hearing with the Examining Authority on 24th June 2026, NGET stated openly **for the first time** since it made its application on the 29th August 2025 for its draft Development Consent order including Plot 8/42 that they **do not actually need to access ARU Writtle through our Equine Centre**. Instead they stated they will gain access from the West of ARU Writtle via Newney Green. The real outcome of this is that Plot 8/42 is not required to form part of the DCO.
- 4.2 NGET further explained to the attendees at CAH 3 on that day that it would re-classify the extent of Plot 8/42 as “Class 8 land”, and without further explanation. Further consideration of the extensive documentation demonstrates that “Class 8 land” is a non-

statutory artificial category created by NGET in Table 1.1 of its Statement of Reasons. Under column 1 of that Table, that Class is described “uncoloured”, and under column 3 the Table describes that the “Principle Relevant DCO Article” is “N/A”, that is, “not applicable”. I reasonably understand that the NGET has affirmed that Plot 8/42 remains not necessary to acquire and that it will remove the yellow colouration of that Plot from its certified plans forming part of the draft Order.

- 4.3 This is welcomed and vindicates the position we have been driven to take to take by the inclusion of Plot 8/42 inside the scope of compulsory acquisition powers in the draft development consent order, from the beginning of this process in August 2025. To my mind, it is unfathomable why NGET should choose to change the plans to remove the yellow colouration from the plans and at the same time not delete the extent of the red line encompassing Plot 8/42 also. This strikes me as a surprising “pic’n’mix” approach to drawing amendments and is inexplicable. For practical purposes, it remains unacceptable to have a draft statutory instrument evidenced as both stretching into our land but at the same time being devoid of content.
- 4.4 For correct and orderly drafting in the public interest of a statutory instrument and upon which any future unidentified third party may rely on its terms and certified plans, the whole of the red line around the now former Plot 8/42 should be excised from all plans and no certified plans should include such a red line. It is confirmed by NGET to be no longer required, and its removal from the redline of the land is important to avoid any confusion in the future and to avoid our land being unnecessarily blighted by seemingly being required for the DCO yet at the same time (by reference to the separate document “Statement of Reasons”, Appendix A, Table 1.1 (May 2026)), not actually being required. It is wholly unreasonable that NGET chooses to make only a part amendment to its drawings and to not wholly correct its plans to align with its stated position.
- 4.5 ARU has had to incur significant professional and legal advice to reach this position as at CAH 3 on the 24th June 2026. We require the redline to be amended to remove Plot 8/42 so a clear end can be reached on this issue to avoid further unnecessary costs being incurred and request that the ExA recommend the deletion of the extended red line around Plot 8/42 from Section F, Sheet 8 of all certified plans.
- 4.6 The Examining Authority previously at CAH 2 first recognised that the “Negotiations Tracker” documentation submitted by NGET to the ExA and to the Secretary of State did not actually relate to both NGET and to UKPN. I consider this most surprising and deeply regrettable that NGET allowed by its representations this confusion to arise in the minds of the ExA. Only from that hearing has the ExA first appreciated that there has been no evidence at all of UKPN’s engagement with any third party and at the same time NGET has included in its draft Order proposed powers of compulsory purchase for both NGET and UKPN. I am very surprised at such an inclusion also for the reasons I have given above.

- 4.7 At the CAH3 Hearing on the 24th June 2026, and I note the passage of real time since CAH 2, the Examining Authority raised its concerns regarding the lack of engagement and evidence of engagement to the then date by UKPN. UKPN affirmed its actual position and then confirmed that *initial* letters only went out to most of the interested parties on 25th March 2026 (as set out in the CAH3)). This mean that ARU Writtle is not in a position to be able to properly consider our objections to UKPN works and vice versa at this stage. This is a profoundly unsatisfactory position for ARU to find itself, and clearly we are not alone – because each and every other Affected Person in relation to this draft development consent order will be in the same position.
- 4.8 I can see no reference at all in the Statement of Reasons to the need for a development agreement between NGET and UKPN remaining outstanding at 29th August 2029, nor can I find any reference int the Examination Library to clear evidence that NGET agreed the terms of a necessary precondition to its actual involvement in a design development agreement only in November 2025.
- 4.9 It is again most disappointing that we are forced to incur significant professional and legal costs considering the implications of a proposal where the Acquiring Authority itself has not followed Parliament’s own NPS Guidance, nor the procedures and common law and guidance rules required of them, and in circumstances where there is no detail of a the interior content of the project because it is an ‘outline’ “Rochdale Envelope” DCO the detail of whose internal parts remains necessarily not known, detailed nor fixed, nor in evidence in front of the ExA nor Secretary of State. It is clear that he proposal has not been properly considered or communicated, let alone affording us to have the opportunity to negotiate a suitable alternative.
- 4.10 We have however arranged a site visit with UKPN on 16th July 2026 (which will be its first site visit with us regarding this project, as per paragraph 3.17 above). At this meeting we will explain that we will require UKPN to directionally drill horizontally below the ground surface level of the ARU paddocks (at an appropriate depth that will ensure no microshocks to horses or pedestrians at ground level and no ground surface disturbance), rather than, as necessary in order to avoid serious injury and possible deaths to horses in our *circa* 90 strong herd, and related significant risk of injury to students (including children) and staff at the Educational Establishment as detailed further in the witness statement of Caroline Flanagan (Head of School of Agriculture, Animal and Environmental Sciences), and we request the Recommendation by the ExA and imposition by the Secretary of State of a micro-siting protected provision (or else a requirement) to ensure this happens.
- 4.11 The effect of such a micro-siting a protective provision (or a requirement to like effect) would be to create gap *inside* the extent of the Rochdale Envelope *through* which the *overhead* electric line of NGET would be enabled to pass safely and across the Northwesternmost corner of ARU land *inside* the area of the red line and limits of

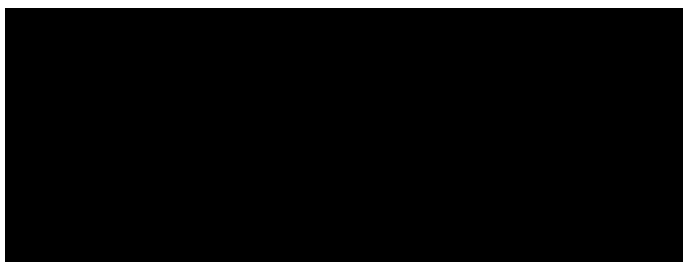
deviation but *outside* of the extent of the two Western paddocks South of the footpath inside of Plot 8/29 (i.e. excluding the paddock to the North of the footpath), and so forming an actual gap inside of the Envelope *between* the corner of one paddock and the edge of the red line to its West through which the overhead line can traverse between pylons. By way of example, Jane Kenny in her witness statement submitted alongside this deadline 6 submission, produced a route plan and explained further the route of the overhead electrical cable spanning between pylons reference TB 166 and TB 165 which is shown in dark blue line on the attached plan Exhibit MLP 1/1.

- 4.12 The effect of a micro-siting protective provision (or a requirement to like effect) would be to enable the electric line of UKPN to pass safely and *below* ground level through Plots 8/27, 33 and 36 also inside the extent of the Rochdale Envelope. To assist please see overlay plan Exhibit MLP 1/2 showing the overlay of the dDCO plots with ARU Writtle.
- 4.13 Such micro-siting would comply with the Department's Code of normal good practice in respect of new lines over schools and simultaneously ensure ongoing safe operation of the school from micro-shock situations and related significant risks of real injury and harm to horses, students and staff.
- 4.14 Because such micro-siting protective provisions are agreeable by ARU, it remains the case that no compulsory acquisition remains required of ARU land for oversailing of that Northwesternmost corner of ARU land nor below the paddock areas on its Northern parts.

Statement of Truth

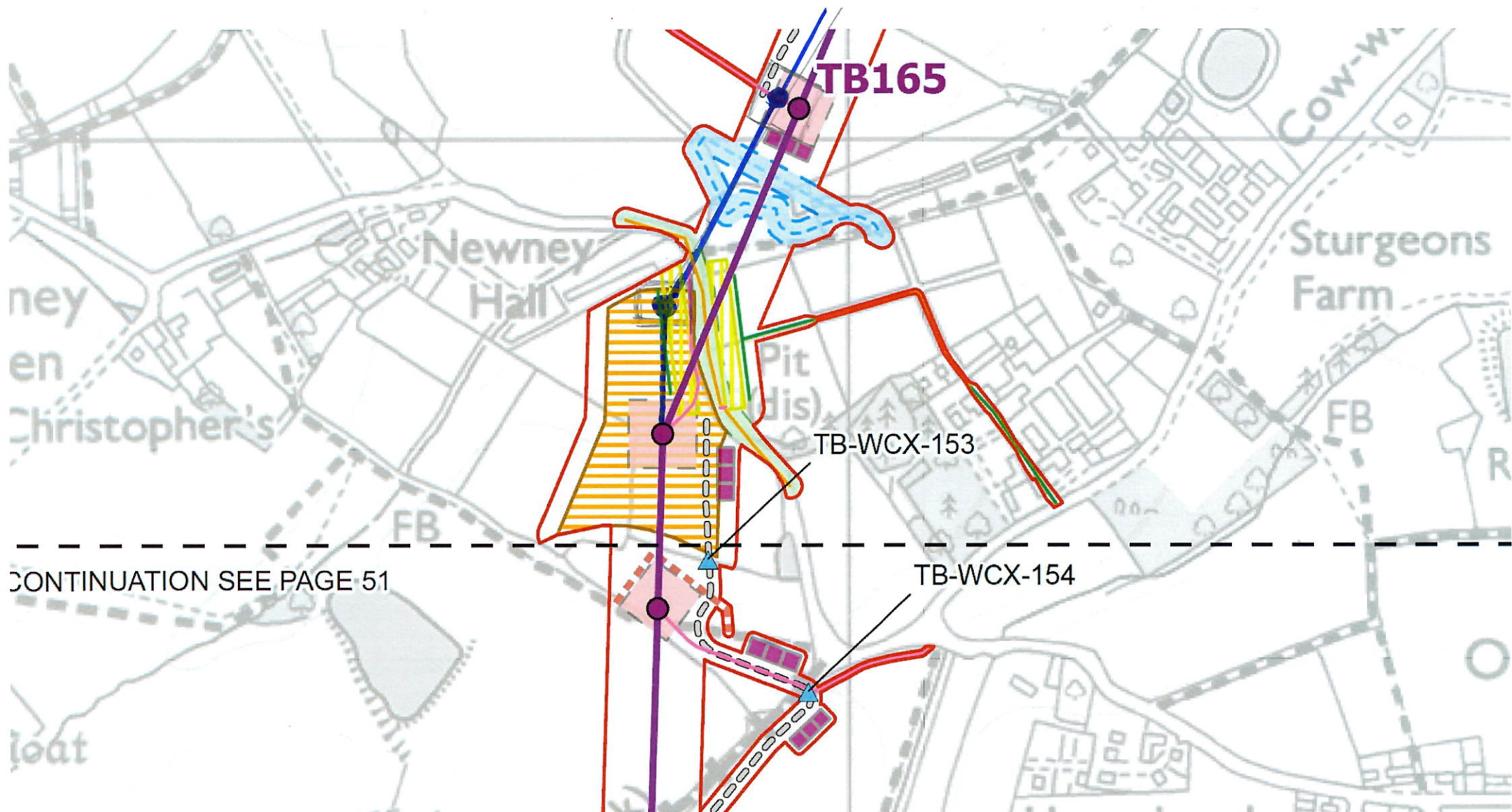
I understand that proceedings for contempt of court may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief in its truth.

I believe that the facts stated in this Witness Statement are true.



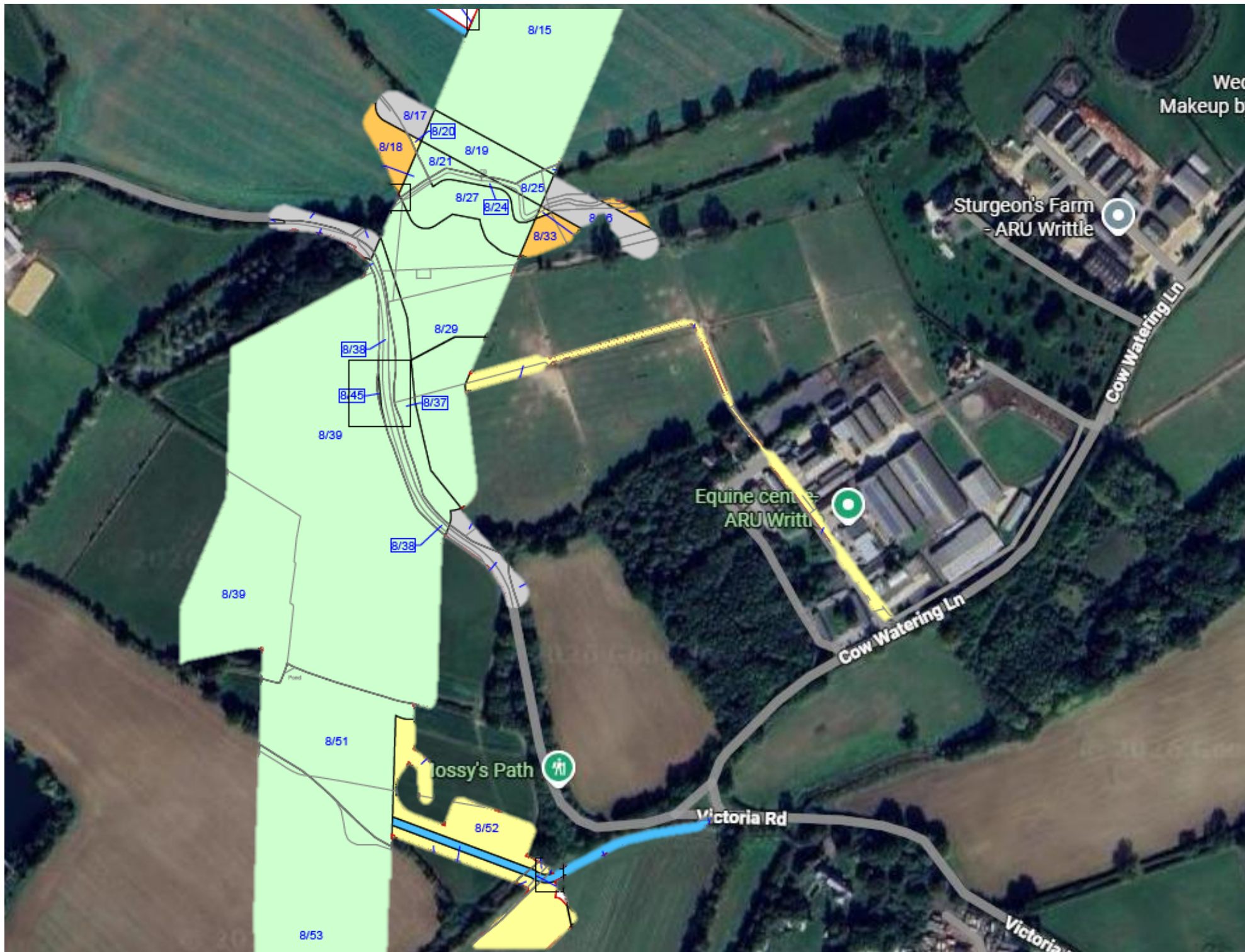
Dated 7th July 2026

EXHIBIT MLP1/1



N-T PROJECT - ARU WRITTLE
ARU Writtle Overhead Electrical Line Micro-siting Plan

EXHIBIT MLP1/2



Project	Anglia Ruskin University, Writtle
Subject	Response to National Grid Deadline 6 Submission
Reference	26086
Date	7 July 2026

1 INTRODUCTION

1.1 Purpose

- 1.1.1 This Technical Note (TN) has been prepared by expert transport consultancy “KMC Transport Planning Ltd” to review National Grid Electricity Transmission’s (the Applicant’s) Deadline 6 submission relating to transport matters associated with Anglia Ruskin University (ARU) Writtle Campus. The submissions relate to the Applicant’s desired use of a perpetual transport corridor inside of the ARU Writtle Campus to ensure permanent access for both the construction and ongoing maintenance of a part of the envisaged overhead cables and related pylons proposed to be situated at the western end of the ARU land at Writtle Campus, and forming part of a Works included within the Norwich to Tilbury Development Consent Order statutory instrument (DCO).

1.2 Content

- 1.2.1 This TN provides as follows:
- Update as of 24th June 2026 on the Applicant’s Desire for Permanent Access along Plot 8/42 through the functioning ARU Writtle Equine College;
 - Review and response to transport matters set out in [REP5-193] 8.4.11.1 *Applicant’s Response to ARU Writtle [REP4-348] and ExQ CA 2.1 HW 2.22.1 and HW 2.2*;
 - Review and response to [REP5-150] *Outline Construction Traffic Management Plan – Tracked Changes Version*; and
 - Comparison to recommendations on actions to mitigate transport impacts on ARU Writtle previously made in our Deadline 3 submission ‘*Comments on the applicant’s draft itinerary for the ASI*’ [REP3-113] and Deadline 4 submission ‘*Comments on any further information or submissions received by deadline 3 and post hearing submission*’ [REP4-348].

2 UPDATE

2.1 Draft DCO

- 2.1.1 By reference to the most recent iteration of the draft development consent order, the proposed powers relating to roads and highways include as follows. The draft Development Consent Order ("dDCO") was applied for on 29th August 2025 by NGET. By Article 3(1) of the dDCO, seeks development consent *for* the authorised development set out in Schedule 1. Within Schedule 1, the works described include "Associated Development" in broad terms: "Such associated development not listed above, within the Order Limits, as may be necessary or expedient for the purposes of or in connection with the construction or maintenance of the above Work Nos or any of them, including – a) ramps, means of access (including crossovers), footpaths, bridleways, trackways and pontoons; ... c) temporary vehicular access road(s), hardstanding... d) embankments... fencing and culverts...i) tree, hedgerow and vegetation planting and maintenance works; m) works to streets and any alteration, removal or installation of road furniture, traffic signage and signals, including where required to facilitate the construction of temporary accesses; and u) such other works, including scaffolding .. as may be necessary or expedient for the purposes of or in connection with the construction of the authorised development and which do not give rise to any materially new or materially different environmental effects from those identified in the environmental statement".
- 2.1.2 Article 16(1) would empower NGET to "temporarily close, alter or divert any street or public right of way shown on the access, rights of way and public rights of navigation plans or within the Order limits and may for any reasonable time – a) divert traffic from the street or public right of way; and b) subject to paragraph (3), prevent all persons from passing along the street or public right of way".
- 2.1.3 Article 16(1) is subject alone to paragraph 16(3) and is not itself subject to paragraph (4).
- 2.1.4 Article 16(4) provides a further and separate power to NGET to "temporarily close, alter or divert the streets or public rights of way specified in columns (1) and (2) of Parts 1 to 4 of Schedule 8...". Paragraph (5) provides that NGET must not temporarily close, alter or *divert* a) the streets or public rights of way specified in column (4) without first having consulted the street authority. Within Schedule 8, Part 1, Streets to be Temporarily Closed, in the Area of Essex County Council, under Column (2), Newney Green", column (3) describes the "extent of temporary closure as shown on the access, rights of way and public rights of navigation plans" to include "Newney Green between points Point SM-F-028 and Point SM-F-029 as shown on Section F, Sheet 8" and Column (4) describes the "Temporary Diversion as shown on the access, rights of way and public rights of navigation plans" to include a "Diversion Route via lines SMD-F-43 [and] SMD-F-044".
- 2.1.5 Essex County Council is not entitled to *prevent* exercise by NGET of the exercise of its Article 16(1) or (4) powers. Only under Article 16(5)(b) in respect of matters not described in Schedule 8 is ECC entitled to not consent to temporary closure, alteration or diversion, and even then ECC is required to "not unreasonably withhold or delay" its consent.

- 2.1.6 Article 17(1) would empower NGET to “for the purposes of the authorised development – a) form and lay out means of access, or improve existing means of access, in the location specified in column (2) of Schedule 9 (access to works); and b) with the consent of” ECC may form and lay out “such other means of access” at such locations within the Order limits as NGET reasonably requires for the purposes of the authorised development.
- 2.1.7 As with Article 16(5)(b), ECC must provide consent in respect of paragraph (1)(b) situations but even then ECC is required to “not unreasonably withhold or delay” its consent, and paragraph (2) deems ECC consent to have been given after 25 days.
- 2.1.8 Within Part 5, Acquisition and Possession of Land, Article 27(1) would empower NGET to a) “enter on and take temporary possession of – (i) so much of the land specified in column (1) of Schedule 11 ... to exercise the powers described in the book of reference”. Schedule 11 includes under Column (1), Section F, “Plot F-8/42”.
- 2.1.9 Article 49 and Schedule 13 provide for Traffic Regulation Orders. Within Part 6, by Article 49(1), NGET “may at any time for the purposes of the authorised development or purposes ancillary to the construction or maintenance of the authorised development – a) prohibit waiting of vehicles and regulate vehicular speeds by imposing a speed restriction on vehicles in the manner specified in Part 1 of Schedule 13 (Traffic Regulation Orders) on a road specified in column (2) and along the lengths and between the points specified in column (3) in the manner specified in column (4) of that Part of that Schedule; b) *prohibit use* of roads and/or regulate the direction of vehicular movements in the manner specified in Part 2 of Schedule 13 (Traffic Regulation Orders) on a road specified in column (2) and along the lengths and between the points specified in column (3) in the manner specified in column (4) of that Part of that Schedule...”.
- 2.1.10 Article 49(1)(b) does not include any limit on the period of time that a stretch of highway may be closed for “use” by vehicles.
- 2.1.11 Article 49(1) is subject to the provisions of Article 49 – but the provisions do not entitle ECC to prevent the carrying out by NGET of the Traffic Regulation Order. Instead, “Without prejudice to the scope of the specific powers conferred by paragraph (1), paragraph (2) leaves the period in the power of NGET to specify. Paragraph (2) requires ECC consent to not be unreasonably withheld in respect of (e) “access” by vehicles (but not the use of the road), and paragraph (4) requires NGET to give notice to ECC of its paragraph (1) exercise of powers and the Order is deemed to be a Traffic Regulation Order made by NGET as if duly made by the traffic authority.
- 2.1.12 Within Part 2 of Schedule 13, Traffic Regulation Orders, Column (1) describes ECC, Column (2) describes “Newney Green”, Column (3) describes “Extent as shown on the Traffic Regulation Order Plans” and “Between Points TR-F-025 and TR-F-026 as shown on Section F, Sheet 8, and Column (4) describes “Prohibition on vehicular access”.
- 2.1.13 Within Section F, Sheet 8 of 10 of the Traffic Regulation Plans, identifies: a) the red outline edge of the Order Limits; b) bisecting the Order Limits a solid blue line described as “Newney Green” and that spans between Points described as “TR-F-025” and “TR-F-026” and that the Key to the

Plan identifies as "Street Management: Temporary Traffic Regulation Order; c) a blue dot at each end of the solid blue line is identified in the Key to the Plan as "street management end point".

- 2.1.14 It can be seen from that Plan, that consequent on Article 49(1)(b), NGET would be empowered to shut to all vehicular traffic the length of Newney Green highway on each side of and inside the extent of the Order Limits for "use" by vehicles, and that within those Order Limits and directly adjacent to the (closed) Newney Green is situated ARU Writtle Land.
- 2.1.15 Noting that since before 29th August 2025, NGET had not itself proposed the same, during the Examination Period, ARU Writtle proposed that the use of Plot 8/42 was not necessary because on the face of the dDCO its terms included a "proposed road closure TRO ... for Newney Green... to remove the need for access through the College via Plot 8/42" and that provision itself enabled for direct access inside the Order limits, from the west, to pylon overhead line locations.
- 2.1.16 In paragraph 2.2.19 of its Response to ARU Writtle (June 2026), NGET characterised the proposals of ARU to avoid NGET traffic from passing through ARU Writtle land as Options 1-3 and that would result in the "direct access from Newney Green" to ARU Land from the West, and "access from the haul road to the south-west, crossing Newney Green", each with a new temporary non-formal access directly into ARU Writtle College horse paddocks and a non-formal cross-over access".
- 2.1.17 By way of update, ARU and KMC met with ECC by means of a Teams Conference at 9.30am on 24th June 2026. ECC confirmed in that meeting that it had considered the "Options" characterised by NGET in its Response and set out that of the 3 options its preference was for either Options 1 and 2. It was understood that, this was due to the length of the closure on Newney Green.
- 2.1.18 During CAH3 ISH on the 24th June 2026, NGET confirmed in fact that it did not actually need "Plot 8/42" and that it would instead categorise that Plot as "Class 8" land. "Class 8" land is not a legal title but a reference to Table 1.1 of the Statement of Reasons where it is used as a category to describe "uncoloured" land as "land not subject to powers of acquisition nor temporary use", and in Column 3 describes "N/A" ("not applicable") under the description "Principal Relevant DCO Article".
- 2.1.19 Therefore, by way of update, as at 24th June 2026, the Applicant NGET accepts in fact there to be no need for Plot 8/42 and has confirmed to the ExA (and to the Secretary of State) that NGET will remove the yellow colouration inside Plot 8/42 in line with its acceptance that Plot 8/42 is not actually necessary.

3 APPLICANT'S RESPONSE TO ARU WRITTLE

3.1 Introduction

- 3.1.1 This section of the ARU Deadline 6 TN Response provides a review and response to transport matters set out by NGET in [REP5-150] 8.4.11.1 *Applicant's Response to ARU Writtle [REP4-348] and ExQ CA 2.1 HW 2.22.1 and HW 2.2*. It continues to be noted that that Response itself is to the Question of the ExA by which the ExA itself properly raised the question of whether there was a need for acquisition of ARU Writtle Land for the authorised development. This TN responds to the parts of that Response that relate to traffic and highways matters, whilst notes that there is inter-linkage between those matters and any desired use of ARU Land.
- 3.1.2 This TN does not seek to reiterate the sworn evidence of ARU Writtle and resulting points made by ARU Writtle on the impacts of traffic movements through an operating equine college or on the ground surface of ARU Writtle Land as a result of compression from scaffolding erected by NGET. These are comprehensively set out in ARU Writtle's prior submissions '*Comments on the applicant's draft itinerary for the ASI*' [REP3-113] and '*Comments on any further information or submissions received by deadline 3 and post hearing submission*' [REP4-348], and further addressed in this Deadline 6 Written Submission. For expediency, this ARU Deadline 6 TN Response does not intend to replicate all transport comments made by the Applicant, but looks to summarise and respond where appropriate.

3.2 Response to Summary of Powers Provided within the draft Development Consent Order

- 3.2.1 This TN has summarised the powers sought by NGET in its draft statutory instrument as set out above and refers to those.
- 3.2.2 At paragraph 2.2.5 of its Response, the Applicant described its powers under Articles 16 (and their extent under Schedule) and 49 (and their extent under Schedule 13, Part 2) but misdescribes the scope of Article 49 as being to "restrict access". This is not correct because Article 49(1)(b) would entitle NGET to "prohibit use of roads by through traffic" "at any time for the purposes of the authorised development or for purposes ancillary to the construction" of the development (without further consent). By contrast, and "without limiting the scope of the specific powers conferred by paragraph (1)", Article 49(2)(e) would entitle NGET to permit or prohibit "vehicular access" to any road with the consent of ECC and that "must not be unreasonably withheld". The Plans referred to above that show the extent of the proposed TRO to extend along the totality of the boundary between ARU Writtle Land and Newney Green highway. On its face, the draft DCO continues to evidence that the solid blue coloured length of that highway would be authorised by the statutory instrument to be closed for "use" by vehicles, including "use" inside the extent of the Order limits. That makes practical sense as it allows NGET to move southwards and northwards over the part of Newney Green as part of the land encompassed by the Order limits and for "the purposes" of the development including its construction. It is difficult to see how NGET cannot rely on the use of an area of highway that is closed for "use by vehicles" or how any vehicles could be using that area of highway during a

closure. This need to protect vehicles “using” (Article 49(1)(b)) or “accessing” (Article 49(2)(e)) Newney Green is the justification for the use of scaffolding, but under a road closure there are no highway users nor any traffic requiring “access” (Article 49(2)(e)). Given under Article 49(1)(b) the Applicant can manage the extents of their closure for “use” who would need protecting, as such scaffolding would not be required (as set out in Option 3 below). On this basis, the impacts of the scaffolding on ARU Writtle can be avoided by implementing a road closure.

- 3.2.3 At paragraph 2.2.6 and paragraph 2.2.7 of its Response, the Applicant sets out that they have the powers to deliver an access directly from Newney Green under Article 17(1)(b) *with the consent* of Essex County Council. This is an incomplete response by NGET because it is clear from NGET own draft DCO terms that ECC cannot unreasonable withhold its consent to proposals by NGET and thereby NGET is the driver of the consent process.
- 3.2.4 In further response to Paragraph 2.2.8, land along the boundary of Newney Green is owned by ARU Writtle, who have indicated that they are content to facilitate the delivery of a direct access from Newney Green in order to negate the need for the Applicant to use Plot 8/42. Ideally, this situation would have been agreed before 29th August 2025 or at any time since to 24th June 2026, but has been recognised by NGET who has formally affirmed to the ExA that Plot 8/42 is not actually necessary and will be classified as “Class 8” land to which the draft DCO has no application.
- 3.2.5 At paragraph 2.2.12 the Applicant sets out that the use of Plot 8/42 protects passing highway users, facilitates a safe system of work for scaffold installation and removal, and segregates construction activities from the public highway. All of these conditions are very likely to be met under a road closure or alternative access location via Newney Green without the need to access via Plot 8/42, and, whilst the use of Plot 8/42 may separate these activities from highway users, it brings these movements into direct conflict with an operating equine college.

3.3 Consideration of Alternatives in Response to Consultation

- 3.3.1 Paragraph 2.2.15 sets out that a new bellmouth from Newney Green was considered and assessed by the Applicant. However, given the above, the construction of a bellmouth and the use of scaffolding by NGET appears to be unnecessary. The Applicant also indicates that delivery of the option to adoptable safe standards in accordance with Design Manual for Roads and Bridges (DMRB) requirements would necessitate extensive vegetation clearance and tree loss to accommodate the required visibility splays. However, that assessment appears to have not fully considered Article 49(1)(b) and Schedule 13 (a TRO to close the highway for use by vehicles so that the highway is not operational for a period, but instead during that use closure period forms a part of the Order limits constructional area), and also Article 3(1) and Schedule 1, Associated Development, that describes extensive powers by which NGET can construct accesses of all kinds in any event.
- 3.3.2 The extent of the assessment that is said to have been undertaken by NGET has not been identified, nor disclosed nor have any submitted materials been identified for comment. However, the required visibility splay would be considered in the context of the TRO closing the

Newney Green to “use by vehicles”, through discussions with Essex County Council and, if opened, notwithstanding the TRO closing the highway for such periods as NGET may choose, potentially via a speed survey, which could significantly reduce any perceived visibility requirements and associated vegetation removal. It is notable that Schedule 1 Associated Development would entitle NGET to replant vegetation and provide fences also. The potential continues to exist for a pragmatic and realistic approach, given the evident exceptionally low “use” of Newney Green Lane and minimal (if any) “access” requirements, with potential traffic management measures (such as a TO/15) able to manage the asserted single 1no. ‘tractor like’ vehicle that NGET contends would be used to pull tight the overhead cables from inside the ARU Writtle campus Land. As has remained the case since before 29th August 2025, this approach would enable NGET to access directly from the (then closed) highway to the west of ARU Writtle Land without construction of a DMRB compliant access as the closed highway would then for a period be part of the construction site inside the red outlined area. However, more importantly and as appears self-evident from Article 49(1)(b) and Schedule 13 (TRO), it is apparent that construction of an access from the closed Newney Green highway is not even required when the proposed powers of Article 49(1)(b) are exercised, as and when by NGET, to “prohibit use of roads by through traffic”.

- 3.3.3 The Applicant goes on to contend at paragraph 2.2.16 that they have developed an alternative arrangement, whereby Newney Green would be closed, and the only vehicle that would need to use Plot 8/42 would be a telehandler, and that this is the arrangement submitted within the draft DCO. This contention has now been overtaken by the proper concession by NGET on 24th June 2026 that Plot 8/42 is not actually necessary.
- 3.3.4 As above, it remains unclear why the telehandler could not always just access ARU Writtle campus directly from Newney Green, under relevant traffic management, such as a TO/15 or by reliance on Article 49(1)(b) and the Schedule 13 TRO, rather than through the site.
- 3.3.5 It is also important to note that it remains the case as at Deadline 6 that the Applicant does not have a Main Contractor engaged and there is no control that commits that Main Contractor to use or non-use of Article 49(1)(b) and Schedule 13 TRO road closures, nor to the contended single 1no. vehicle within the Construction Traffic Management Plan. As such, the potential level of use of any access over and into ARU Writtle Land (now excluding Plot 8/42) remains of a real concern until a commitment or control is put in place and a Requirement regulates that evidenced uncertainty.

3.4 Current Status

- 3.4.1 The current status as at Deadline 6 is that since 24th June 2026 and the expression of the views of Essex County Council, NGET accepts that Plot 8/42 is not necessary for it to use because in fact NGET can make use of direct access from Newney Green highway from the West to ARU Land (so far as such access to ARU Land remains necessary at all). At the Teams Call of 24th June 2026, ECC affirmed that it preferred Options 1 and 2 to Option 3, based on the length of closure that it has been indicated by the Applicant is required.

- 3.4.2 The Applicant had set out its consideration of three access options is being undertaken following a site visit with ARU Writtle and discussions with Essex County Council. These options are as follows:
- Option 1: Direct access from Newney Green into the field;
 - Option 2: Access from the haul road to the south-west, crossing Newney Green; and
 - Option 3: Overhead line pulling and stringing without scaffolding.
- 3.4.3 Further details on the options are summarised by the Applicant in their Response submission.
- 3.4.4 The Applicant set out at paragraph 2.2.4 that it is looking at the options in discussions with Essex County Council, but that until an approach is agreed, they retain the need for the use of Plot 8/42. Given the terms of the draft DCO referred to above, it remains difficult to see where ECC has the authority to dictate whether or not NGET (and its Main Contractor) may use the Article 49(1)(b) and Schedule 13 TRO road closure.
- 3.4.5 At the 24 June 2026 3rd Compulsory Acquisition Hearing (CAH3), it was identified by the Applicant that Essex County Council's preference is for Option 1 or 2 over 3, and on that basis the Applicant confirmed to the ExA that it has no need for Plot 8/42 and that it can be removed from the DCO.
- 3.4.6 However, in line with Essex County Council's position as discussed in our Teams Call, based on the above options, it is considered sensible to comment on the outcome of the preferred Options 1 and 2 by reference to three further candidate situations based on the NGET Response to the ARU Representations and the ExA's Questions. These are as follows.
- Access via Plot 8/42 for 1no. Telehandler
 - New access from Newney Green
 - 12-week road closure of Newney Green, with no new access
- 3.4.7 It seems clear that the simplest way to avoid any impact on the ARU Writtle site, including the impact of scaffolding on ARU land, would be to implement a road closure, which the Applicant and its Main Contractors has wide and specific powers to do through the draft DCO under Article 49(1)(b) (prohibition on use by vehicles of that highway for the duration of the TRO triggered by NGET or its Main Contractor). This would enable the single telehandler to simply drive over the Newney Green verge and negate the actual routing of vehicles *through* a sensitive site and would avoid any vegetation loss. Some concerns are raised around the length of the closure, but the draft DCO would entitle NGET and its Main Contractor to specify the period of closure, and KMC experience on the delivery of other NSIP indicates that long term closures on minor roads, in some cases much *longer* than 12 weeks, are not uncommon in practice for projects of this scale. Whilst we understand that use of the TRO is not Essex County Council's preferred solution, it would avoid subsequent impacts on ARU Writtle land, ECC cannot prevent such a closure under Article 49(1)(b) and the potential remains to reduce the length of the closure through reducing the scaffolding requirements by relocating the crossing location, and, as above, ARU Writtle have commissioned a traffic survey to identify the actual level of traffic likely to be impacted to inform further Essex County Council's preference.

- 3.4.8 In the scenario where an access is needed from Newney Green, and given access is contended by NGET to be required for no more than 1no. telehandler for scaffold erection, it appears reasonably feasible to achieve that situation directly from the highway over the intervening verge and without the construction of any formal access, albeit it may require some form of temporary traffic management and a small amount of vegetation clearance. The proposed draft DCO Article 3() and Schedule 1 powers in relation to “associated development” could be used to reinstate the land and highway before it reopened for use by vehicles. This is a pragmatic scale of intervention given the level of access contended by NGET (in the absence of engagement of a Main Contractor).
- 3.4.9 Finally, whilst not a suitable scenario, and whilst it is understood it is not being progressed further after the 24th June 2026, in the scenario proposed by the Applicant there is the desire for one vehicle to access via Plot 8/42. However, there is no control on this within the CTMP or DCO and a primary contractor is not on board for the project. The potential level of use of any access, including Plot 8/42 remains of a concern until a control is put in place via the Construction Traffic Management Plan. This scenario has been overtaken by the recognition by NGET from 24th June 2026 that there is no actual need for Plot 8/42.
- 3.4.10 In summary, and on the basis of the above, ARU Writtle welcome the removal of Plot 8/42 and the decision to access via Newney Green. However, the Applicant has powers under Article 49 to implement a road closure to “prohibit use”, along the stretch of Newney Green highway that is adjacent to the ARU Writtle land for the limited period that NGET will be installing overhead cables over the part of Newney Green inside what will remain part of a construction site during that closure of use of that part of the highway. It appears, the Applicant only requires use of ARU Writtle land to construct an ‘access’ into ARU Writtle for 1no. vehicle associated with scaffolding on ARU Writtle land. But both of which are only needed in a scenario where “use” of a closure is not relied on by NGET and NGET ignores its Article 49(1) power. The scaffolding has a significant and prolonged negative impact on the ground surface of actual functional useability of the ARU Writtle paddock site areas for horse traffic and the construction of an access would have some associated negative impacts on hedgerows. The simplest way to avoid all these impacts would be for the Applicant to minimise the length of the road closure required and implement a closure of its “use” for the evidenced limited period during which NGET is installing overhead cables between pylons inside the construction site of its red outlined area and during which the highway can be closed for use by all highway traffic. ARU Writtle will provide ECC with a traffic count in due course to evidence the reality of the limited impact of the closure of the use of that highway for the limited period of cable installation.

3.5 Additional Traffic and Transport Measures

- 3.5.1 The draft DCO powers have been referred to above. These powers include the diversion of traffic along Cow Watering Lane. See Article 16(1) and Schedule 8 of the draft DCO as a result of the closure of Newney Green highway between Points Point SM-F- 028 and Point SM-F-029 on Sheet 8 in Section F of the Access, Rights of Way and Public Rights of Navigation Plans. Separately from the TRO provided for by Article 49(1)(b) and Schedule 13, the Article 16 and Schedule 8 Plan referred to identifies: a) by a dashed and “xx” blue line, Newney Green as subject

to a “street management: temporary closure” between Points SM-F-028 and Point SM-F-029”; and b) by a dashed blue line, a diversion along Cow Watering Lane between along “Route SMD-F-043”.

- 3.5.2 The Applicant provides a response to the sworn evidenced real concerns raised by ARU Writtle relating to increased traffic diverted along Cow Watering Lane during any Article 16 street management closure of Newney Green and the resulting effect on the safe crossing by students / horses of Cow Watering Lane from one part of the ARU Writtle Campus on the north side of that land to and from the other part of the ARU Writtle Campus on the south side of the lane.
- 3.5.3 The diversion of traffic along Cow Watering Lane and therefore across a horse crossing point that connects the two parts of ARU Writtle Campus (highlighted at Figure 2.1 below), is evidently a real concern for ARU Writtle. In particular, no survey data has been submitted with its Application nor to date into the examination showing the level of traffic that uses Newney Green, which without it is currently not possible to determine the level of increase in traffic during a closure. Given that approach, a survey has now been commissioned by ARU Writtle.



Figure 2.1 – Writtle Campus and Horse Crossing Locations

- 3.5.4 Two scenarios are advanced *by the Applicant* that result in road closures, and subsequently a diversion route that would result in additional traffic at the Cow Watering Lane horse crossing point.
- *Two short term* closures where stringing overhead electrical cable over and above across the highway is occurring (suggested by NGET and not the actual Main Contractor) to be a total of up to *4 hours of road closure*); or
 - A longer term closure associated with the full closure of Newney Green to negate the need for scaffolding on the highway (12 weeks).

- 3.5.5 For the short-term cable tightening closure the Applicant contends in the absence of a Main Contractor that the suggested control measures are unnecessary due to the potential timing and short duration and NGET considers that any traffic management measures not only can but will be agreed with Essex County Council through the permitting process of Article 16(4) of the draft DCO.
- 3.5.6 With regards to the short duration, no evidence has been submitted to show the level of impact in terms of changes in vehicle movements, and the potential exists that this is a noticeable change in the number of vehicle movements, as well as an increase in users of Cow Watering Lane who may be less familiar with its special characteristics (e.g. number of equine movements). In particular, it remains to be noted that Cow Watering Lane is not itself a "PAR" and so the requirements and provisions of the most recent Outline Construction Traffic Management Plan (June 2026), Section 6, in particular paragraphs 6.2.10, cannot encompass Cow Watering Lane.
- 3.5.7 Whilst there is no unambiguous express commitment to the closures being overnight (NGET describes these at most and in the absence of a Main Contractor as a *potential*), it is also important to note that overnight movement of horses and pedestrians in the darkness of Cow Watering Lane across and back again at the crossing are not uncommon. Understandably for an equine establishment comprising both students and a herd of 90 horses, nighttime crossings do occur, especially during emergencies where horses have to be moved back to the stables. Consequently, the draft DCO Article 16 and Schedule 8 diversion provisions would result to change the content of and likely increase the potential for conflict by vehicles with horses and with pedestrians (including children) at the crossing point during hours where visibility will be reduced due to darkness.
- 3.5.8 ARU Writtle remains keen to ensure the safe operation of its Educational Establishment with the proposed safe operation of diversions resulted from the draft DCO for the NGET project. Thus, ARU Writtle is not objecting to this scenario provided that the safety of its crossings of the highways is ensured during the construction of the authorised development. Thus, ARU Writtle requires that reasonable management measures, which could be in the form of a push button crossing or another acceptable method such as stop/go managed by an appropriate operative, are implemented to ensure safe crossing during these scenarios.
- 3.5.9 We have discussed this matter with Essex County Council who have recognised that potential conflict and indicated the need for management of these movements. We would recommend that the Applicant discusses this matter with them, and embed this measure expressly and unambiguously within the CTMP and that a Requirement to ensure the same..
- 3.5.10 It is recognised that traffic management requirements *may* be picked up through the permitting process subsequent to the grant of a DCO in this matter, but there remains no guarantee of ensuring the currently identified safety risk nor has any third party committed to the same at this date. KMC's experience from other NSIP and development sites is that it cannot be certain that the particular permitting officer would be familiar with the specific characteristics of each local area and so may be unaware that ARU Writtle Campus cross large numbers of horses at this

location and as result it has specific sensitivities. Therefore, the identified increased risk of conflict between horses and students, and diverted vehicle traffic from construction remains.

- 3.5.11 It is necessary to embed a clear process for identifying appropriate mitigation of these particular impacts, such as in the form of traffic signals or stop/go managed by an operative, for the limited period referred to above and envisaged by the Applicant, within the CTMP or a suitable requirement for the actual mitigation at Cow Watering Lane crossing by ARU to be agreed with Essex County Council.

4 REVIEW OF OUTLINE CONSTRUCTION TRAFFIC MANAGEMENT PLAN

4.1 Introduction

- 4.1.1 This section of the TN Response provides a review and response to relevant changes made in the [REP5-150] Outline Construction Traffic Management Plan – Tracked Changes Version (June 2026).

4.2 Changes

- 4.2.1 At paragraph 5.4.2 the Applicant includes the following text:

There are some isolated locations, such as scaffolding erection, where a haul road will not be available to access the final location. Once the haul road is constructed and operational, it is intended that the majority of construction vehicles will utilise this, along with the PARs, rather than the non-PAR routes.

- 4.2.2 Neither Newney Green highway nor Cow Watering Lane are “PARs” within the scope of the draft DCO. Previous concern has been raised seeking clarity on which vehicles would or would not utilise the PAR was unclear, and the text remains somewhat ambiguous setting out that ‘it is intended, that the majority of construction vehicles’. Clarity should be provided on locations where construction vehicles will not utilise the haul route and the number and routing of these vehicles. It should be clear that where a haul route is available all construction vehicles will utilise the haul route.

- 4.2.3 At paragraph 5.8.3 the Applicant has included the following text:

Alternatives for cyclist and pedestrian access will be considered in circumstances where safe operation of the works or the safe use by active travel users is compromised.

- 4.2.4 Whilst this change does not relate to a matter raised by ARU Writtle, as works are located on routes that active travel users may utilise to travel to ARU Writtle it appears to be ambiguous in its commitment. There should be a clear commitment to maintain safe active travel routes wherever possible.

- 4.2.5 The additions at paragraph 5.8.6 appear to be sensible. It would be reasonable to include parish councils in any notification along with directly impacted education establishments, such as ARU Writtle on the closure of Newney Green. The required notification period (normally a minimum of 21 days) should be made clear within the CTMP.

- 4.2.6 Paragraph 6.2.10, 6.2.11 and 6.2.12 include information on the driver information pack. The information within the pack appears appropriate. However, specific reference should be made to horse riders at the second bullet point for paragraph 6.2.12. At locations referred to as ‘schools’, this should be widened to include all education establishments, such as ARU Writtle.

4.2.7 The additional text included at paragraph 6.2.13, 6.2.14, 6.2.16 is considered to be sensible.

4.2.8 Paragraph 6.2.15 includes the following text:

The driver information pack will be supplemented by additional mitigation for pedestrian and equestrian safety and safety near schools identified within this document (Table 5.7, Table 5.8 and Table 5.9), the Transport Assessment (document reference 7.11) and the Environmental Statement Chapter 16 - Traffic and Transport (document reference 6.16).

4.2.9 As the assessment is based on the Primary Access Routes only, and does not assess the local routes, as set out in our Deadline 3 submission 'Comments on the applicant's draft itinerary for the ASI' [REP3-113] there is no specific reference to the ARU Writtle Campus, however it has been determined by the Applicant that they require 2no. movements to access the ARU Writtle Campus. ARU Writtle Campus should be specifically referenced, where appropriate in the driver information pack and this should be made clear in the CTMP.

5 REVIEW OF ACTIONS

5.1 Introduction

- 5.1.1 This section provides details on the previously submitted requirements that should be undertaken by the Applicant in order to minimise their impacts on the operation of the ARU Writtle.

5.2 Actions

Requirement	Status
The Applicant must assess the deliverability of suitable alternative access from either alternative access locations prior to Deadline 5 of the DCO examination, or as soon as possible, and provide these to the highway authority and ARU Writtle for comment. The locations for the alternative access would be required to be included in express terms in the draft DCO SI Schedule 9 so that they can be implemented under Article 17 part 1(a).	The Applicant is in liaison with the highway authority on options, as outlined above. It has been confirmed that access via Plot 8/42 is not required and access from Newney Green will be progressed. ARU Writtle are of the opinion that no physical access is required from the highway, as all access requirements can be achieved under a road closure. However, if required, any access should be via Newney Green as indicated by the Applicant as being progressed.
The highway authority and ARU Writtle to comment on the suitability of the alternative access by Deadline 6, so the Examining Authority can make an informed decision on the practicality of the alternative accesses as well as their relative benefits and disbenefits.	
The Applicant should include in the draft DCO SI terms that no HGVs will utilise any route otherwise than the Primary Access Routes.	It has been identified that some HGVs will need to utilise the local road network at paragraph 5.4.2 of the CTMP [REP5-150]. Controls should be put on the number of HGV movements allowed to utilise these accesses within the CTMP.
The Applicant should confirm in the draft DCO SI terms the type and number of vehicle movements that might utilise the access, and, depending on the level of movement identified, the impact should be	No commitment has been made by the Applicant within the CTMP to cap these HGV movements.

assessed. The level of movement should be embedded in express terms in the CTMP as a cap for the access. This should include a stated requirement that no HGVs will utilise the access.	
That a commitment is made by the Applicant within the CTMP to include specific reference to the local characteristics of ARU Writtle Campus in the driver's handbook	No specific reference to the campus is included in the CTMP [REP5-150]. It is considered necessary to specifically reference the facility given its specific sensitivities.
The Applicant should commit in clear and unambiguous terms to <u>all</u> construction access to the site being via a closure of Newney Green, rather than through the ARU Writtle Campus 'unless otherwise agreed' and this should be embedded as a control within the CTMP together with the removal of Plot 8/42 from the DCO Schedules and Book of Reference so that it cannot be utilised during operation, ensuring that the access would have to be via Newney Green; and any maintenance access being via Newney Green and the existing footpath to the north of the ARU Writtle Campus paddock area. Absent those clear and unambiguous terms, a Requirement should be imposed to ensure the same.	The Applicant is in liaison with the highway authority on options, as outlined above. It has been confirmed that access via Plot 8/42 is not required and access from Newney Green will be progressed. ARU Writtle are of the opinion that no physical access is required from the highway, as all access requirements can be achieved under a road closure. However, if required, any access should be via Newney Green as agreed.
The Applicant should commit in clear and unambiguous terms to the provision of either TO/15 or push button lights at the entrance to the ARU Writtle Campus, and to liaising with ECC confirming the information that has been submitted relating to Temporary Traffic Regulation Orders, the specific construction requirements for Newney Green (in terms of length of closure), and the proposed level of use of the access. Absent those clear and unambiguous terms, a Requirement should be imposed to ensure	No commitment has been made. The Applicant has indicated in their Deadline [5-193] response that this will be identified through the permitting process. This is not considered to be a sufficient commitment and a requirement should be included to ensure that appropriate mitigation in the form of traffic management is agreed with Essex County Council.

safe crossing of students and horse traffic at that entrance location.	
The following text is included within the outline CTMP: <i>'No HGVs will be permitted to utilise any route other than the Primary Access Route. No HGVs may use any access that is not located on the Primary Access Route.'</i>	The text has not been included and it has been identified that HGVs will be required to utilise the local road network in some cases. A control (i.e. put a maximum limit on) should be put on these movements.
The following text is included within the outline CTMP: <i>'The total number of daily vehicles for any Site Access Point that is not located on the Primary Access Route, including 8/42, will be limited to [Applicant to insert movements and vehicle type] unless otherwise agreed in writing with the local highway authority.'</i>	The text has not been included within the CTMP. It is considered necessary to specifically control (i.e. put a maximum limit on) any movements into the ARU Writtle campus.

**APPLICATION BY NATIONAL GRID ELECTRICITY TRANSMISSION PLC
FOR
A DEVELOPMENT CONSENT ORDER
PURSUANT TO SECTION 37 PLANNING ACT 2008
FOR
THE NORWICH TO TILBURY ELECTRIC LINE ABOVE GROUND**

**PLANNING INSPECTORATE REFERENCE: EN020027
WITNESS STATEMENT**

TOM NEWCOMBE

On behalf:

Interested Party Reference Number: [REDACTED]

1. BACKGROUND AND QUALIFICATION

- 1.1 My name is Tom Newcombe.
- 1.2 I am a Solicitor, Partner, and Head of Planning at Birketts LLP and act for Anglia Ruskin University (“**ARU**”). In my role, I advise ARU regarding legal matters including in relation to the proposed NGET (Norwich To Tilbury) Order.
- 1.3 The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true. Where I refer to information supplied by others, the source of the information is identified; facts and matters derived from other sources are true to the best of my knowledge and belief.
- 1.4 There is now produced and shown to me a bundle of true copy documents marked “Exhibit TN1”. All references to documents in this statement are to Exhibit TN1 unless otherwise stated. References to tab numbers in this statement are to the respective tabs in Exhibit TN1 in the format TN1/[x]

2. INTRODUCTION

- 2.1 This witness statement describes the position regarding the removal of Plot 8/42 from the Book of Reference, the Draft DCO and alterations required to plans (including with respect to three key plans).
- 2.2 In the Second Witness Statement of Michelle Lawlor-Perkins of ARU (also submitted alongside this Witness Statement in advance of Deadline 6) she describes ARU’s engagement with Essex County Council (“**ECC**”) and UKPN and the current position

being taken by National Grid (“**NGET**”) in respect of ARU Writtle in respect of the proposed development by NGET under the proposed NGET (Norwich To Tilbury) Order.

- 2.3 My evidence should be read with the other witness statements and evidence submitted by ARU, including the first witness statement of Michelle Lawlor-Perkins regarding ARU’s continued engagement with NGET to raise ARU’s concerns in respect of NGET’s proposal for a new proposed access road through the ARU Writtle Campus. It is without question that as currently drafted, the draft DCO would result in the permanent entitlement in favour of NGET and others to pass through the Equine Centre at ARU Writtle Campus.

3. **24TH JUNE 2026 HEARING (CAH 3)**

- 3.1 At the CAH 3 issue specific hearing with the Examining Authority on 24th June 2026, NGET put on record that **for the first time** since it made its application on the 29th August 2025 for its draft DCO (which for the avoidance of doubt still currently includes Plot 8/42) that they **do not actually need to access ARU Writtle through the Equine Centre.** Instead they stated they will gain access from the West of ARU Writtle via Newney Green. The real outcome of this statement from NGET is that Plot 8/42 is not required to form part of the DCO.
- 3.2 My understanding is that at CAH 3 NGET further explained to the attendees (including a representative from Birketts) that it would re-classify the extent of Plot 8/42 as “Class 8 land”, but no further explanation was given at that time. “Class 8 land” is a non-statutory category created by NGET in Table 1.1 Appendix A to its Statement of Reasons (Document 4.1). Under column 1 of that Table, that Class is described “uncoloured”, and under column 3 the Table describes that the “Principle Relevant DCO Article” is “N/A”. I understand “N/A” to be the shorthand for “not applicable”.
- 3.3 My understanding of this position is that whilst NGET has stated on record that Plot 8/42 is now not necessary to be acquired, all it is proposing is that the yellow colouration of that plot will be removed from its certified plans forming part of the draft DCO.
- 3.4 My view is that this is not an appropriate way to treat this change of approach by NGET. Merely changing the colouration on plans is not sufficient. One should not and cannot have a situation where ARU are faced with a draft Statutory Instrument which purports to cover an area of their land within the redline order limits yet is categorised in Table 1.1 Appendix A to its Statement of Reasons (Document 4.1) as “uncoloured” and “N/A”
- 3.5 The only correct conclusion to ensure that the red outlined area in a proposed statutory instrument does not unlawfully or inadvertently include development consent order powers affirmed as “not applicable”, to ensure consistency, to avoid confusion in the future regarding any land dealings at ARU and to ensure adequate and necessary third party reliance is that Plot 8/42 and the red outline around it over ARU land should be

removed **completely** from all certified plans and no certified plans should include such a red line. This should be a simple exercise of merely deleting the red line forming Plot 8/42 on the NGET auto-cad type system at the same time as NGET removes the yellow colour from that same plot. It is now confirmed by NGET to be no longer required, and its removal from the redline of the land is important to avoid any confusion in the future.

- 3.6 My assessment of the situation is that, given the proper acceptance of NGET voluntarily to remove the colour yellow but its refusal to remove the red line, the Examining Authority should recommend in the face of NGET refusal the deletion by the Secretary of State of the extended red line around Plot 8/42 from Section F, Sheet 8 of all certified plans, as well as all references to that Plot in the Draft DCO and Book of Reference.
- 3.7 To aid the Examining Authority, the following changes should be made to the following documentation, and for ease of reference I provide extracts at Exhibit TN/1-1 to TN/1-2 :

Document	Change required
Draft DCO (revision F)	Page 243 – removal of reference to plot F-8/42
Draft DCO (Revision F) Article 60, Schedule 19 page 331	Remove Plot 8/42 from all plans listed in this schedule
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 12784 to 12793 – delete entirely
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 12794 – delete first row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13121 – delete reference to F-8/42 from last row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13129 – delete reference to F-8/42 from penultimate row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13130 – delete reference to F-8/42 from third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13133 – delete reference to F-8/42 from first and second rows

Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13134 – delete reference to F-8/42 from fourth row and fifth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13135 – delete reference to F-8/42 from last row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13142 – delete reference to F-8/42 from last row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13147 – delete reference to F-8/42 from last row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13148 – delete reference to F-8/42 from first row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13152 – delete reference to F-8/42 from third row and forth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13162 – delete reference to F-8/42 from second row and third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13170 – delete reference to F-8/42 from third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13172 – delete reference to F-8/42 from fourth row and fifth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13176 – delete reference to F-8/42 from third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13179 – delete reference to F-8/42 from fourth row and fifth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13182 – delete reference to F-8/42 from fifth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13183 – delete reference to F-8/42 from first row and second row

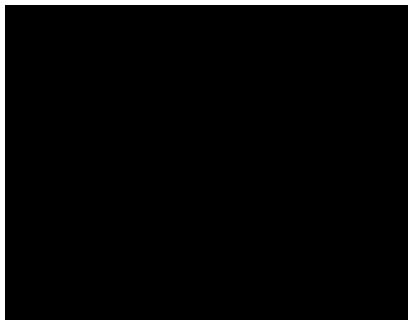
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13190 – delete reference to F-8/42 from first row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13193 – delete reference to F-8/42 from fourth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13194 – delete reference to F-8/42 from second row and fourth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13195 – delete reference to F-8/42 from fifth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13199 – delete reference to F-8/42 from second row and third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13202 – delete reference to F-8/42 from second row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13203 – delete reference to F-8/42 from first row and second row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13211 – delete reference to F-8/42 from third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13212 – delete reference to F-8/42 from second row and third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13216 – delete reference to F-8/42 from third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13218 – delete reference to F-8/42 from second row and third row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13221 – delete reference to F-8/42 from first row and second row

Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13232 – delete reference to F-8/42 from fourth row
Book of Reference (document 4.3) Final Issue D (12 June 2026)	Part 1, Section F, page 13695 to 13703 – delete all pages

Statement of Truth

I understand that proceedings for contempt of court may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief in its truth.

I believe that the facts stated in this Witness Statement are true.



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Dated 7 July 2026

TN/1-1 Extracts from draft CPO

<i>(1)</i> <i>Plot number of land shown on</i> <i>Land Plan</i>	<i>(2)</i> <i>Purpose for which temporary</i> <i>possession may be taken</i>	<i>(3)</i> <i>Relevant part of the authorised</i> <i>development</i>
F-7/72, F-7/75, F-7/78, F-7/80, F-7/81		
F-8/16, F-8/20, F-8/32, F-8/42 , F-8/52, F-8/57, F-8/58, F-8/60, F-8/61, F-8/62, F-8/67, F-8/68, F-8/76, F-8/77, F-8/78, F-8/79, F-8/80, F-8/81, F-8/86, F-8/87, F-8/89, F-8/90, F-8/92, F-8/93, F-8/96, F-8/97, F-8/98	Temporary use for construction, mitigation, maintenance, access and/or dismantling of redundant infrastructure	Work No. 17
F-9/3, F-9/4, F-9/5, F-9/6, F-9/8, F-9/9, F-9/18, F-9/20, F-9/25, F-9/35, F-9/43, F-9/44, F-9/45, F-9/55, F-9/57, F-9/58, F-9/62, F-9/63, F-9/64, F-9/66, F-9/68, F-9/69, F-9/70, F-9/73, F-9/74, F-9/76, F-9/88, F-9/90, F-9/99, F-9/108, F-9/109, F-9/111, F-9/113, F-9/114, F-9/118, F-9/120	Temporary use for construction, mitigation, maintenance, access and/or dismantling of redundant infrastructure	Work No. 17
F-10/3, F-10/11, F-10/12, F-10/16, F-10/22, F-10/26, F-10/28, F-10/29, F-10/31, F-10/32, F-10/34, F-10/36, F-10/37, F-10/39, F-10/40, F-10/41, F-10/43, F-10/47, F-10/55, F-10/57, F-10/61, F-10/72, F-10/74, F-10/76	Temporary use for construction, mitigation, maintenance, access and/or dismantling of redundant infrastructure	Work No. 17 Work No. 39

Section G

<i>(1)</i> <i>Plot number of land shown on</i> <i>Land Plans</i>	<i>(2)</i> <i>Purpose for which temporary</i> <i>possession may be taken</i>	<i>(3)</i> <i>Relevant part of the authorised</i> <i>development</i>
G-1/1, G-1/2, G-1/3, G-1/4, G- 1/5, G-1/6, G-1/18, G-1/27, G 1/29, G-1/31, G 1/32, G-1/34, G-1/35, G-1/36, G-1/37, G- 1/39, G-1/42, G-1/45	Temporary use for construction mitigation, maintenance, access and/or dismantling of redundant infrastructure	Work No. 17 Work No. 39
G-2/2, G-2/6, G-2/19, G-2/45, G-2/47, G-2/55, G-2/56, G- 2/58, G-2/71, G-2/72, G-2/73, G-2/74, G-2/77, G-2/80, G- 2/81, G-2/90, G-2/92, G-2/93, G-2/94, G-2/95, G-2/98, G- 2/99, G-2/100, G-2/103, G- 2/108, G-2/112, G-2/115, G- 2/118, G-2/131, G-2/132, G- 2/136, G-2/139, G-2/140, G- 2/143	Temporary use for construction, mitigation, maintenance, access and/or dismantling of redundant infrastructure	Work No. 17
G-3/13, G-3/15, G-3/16, G- 3/22, G-3/28, G-3/29, G-3/30, G-3/33, G-3/34, G-3/35, G-	Temporary use for construction, mitigation, maintenance, access and/or	Work No. 17 Work No. 32 Work No. 40

SCHEDULE 19
CERTIFIED DOCUMENTS

Article 60

<i>(1) Document title</i>	<i>(2) Document reference</i>
Access, Rights of Way and Public Rights of Navigation Plans	2.5
Book of reference	4.3
Design approach to site specific infrastructure	7.16
Design and Layout Plans (elevations)	2.6.1
Environmental statement (together with any supplemental or additional environmental information)	6.1 to 6.21 (inclusive)
Land plans	2.2
Open access land plans	2.15
Outline archaeological mitigation strategy and outline written scheme of investigation	7.5
Outline code of construction practice	7.2
Outline construction traffic management plan	7.3
Outline employment and skills plan	8.13
Outline landscape and ecological management plan	7.4
Outline public rights of way management plan	7.6
Special category land and Crown land plans	2.14
Traffic regulation order plans	2.4
Trees and hedgerows to be removed and/or managed plans	2.16
Works plans	2.3

TN/1-2 Extracts from book of reference

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 1: Categories 1 and 2

Book of Reference Part 1 (Section F – Chelmsford City Council and Brentwood Borough Council)

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Qualifying persons under regulation 7(1)(a) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	CATEGORY 1 (A person is within Category 1 if the applicant, after making diligent inquiry, knows that the person is an owner, lessee, tenant (whatever the tenancy period) or occupier of the land)			CATEGORY 2 (A person is within Category 2 if the applicant, after making diligent inquiry, knows that the person (a) is interested in the land, or (b) has power (i) to sell and convey the land, or (ii) to release the land)
				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F-8/42	7	0	2,895 square metres, or thereabouts, of agricultural land, college, path and overhead electricity distribution lines situated at Writtle College, Chelmsford	Writtle University College Lordship Road Writtle Chelmsford CM1 3RR Anglia Ruskin University Higher Education Corporation Bishop Hall Lane Chelmsford CM1 1SQ Anglia Ruskin University Bishop Hall Lane Chelmsford CM1 1SQ Writtle College Limited Anglia Ruskin University Bishop Hall Lane Chelmsford CM1 1SQ	NONE	ARU Writtle Lordship Road Writtle Chelmsford CM1 3RR Writtle University College Lordship Road Writtle Chelmsford CM1 3RR Anglia Ruskin University Bishop Hall Lane Chelmsford CM1 1SQ (trading as ARU Writtle) Writtle College Limited Anglia Ruskin University Bishop Hall Lane Chelmsford CM1 1SQ (trading as ARU Writtle)	Victoria Anderson 1 Lordship Cottages Lordship Road Writtle Chelmsford CM1 3RP (see Part 3 for a description) Barclays Bank plc 1 Churchill Place London E14 5HP (as mortgagee to Writtle University College in respect of a legal charge dated 22 May 1997 registered under title EX768800) Catherine Ann Bowles 80 Victoria Road Writtle Chelmsford CM1 3PA (see Part 3 for a description) Brian Kemp Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG (see Part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	CATEGORY 1 (A person is within Category 1 if the applicant, after making diligent inquiry, knows that the person is an owner, lessee, tenant (whatever the tenancy period) or occupier of the land)			CATEGORY 2 (A person is within Category 2 if the applicant, after making diligent inquiry, knows that the person (a) is interested in the land, or (b) has power (i) to sell and convey the land, or (ii) to release the land)
				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F-8/42 (cont'd)						UK Power Networks (Operations) Limited Newington House 237 Southwark Bridge Road London SE1 6NP <i>(in respect of overhead electricity distribution lines)</i> Exolum International UK Limited 1st Floor 55 King William Street London EC4R 9AD <i>(in respect of underground fuel line)</i>	Cadent Gas Limited Pilot Way Ansty Coventry CV7 9JU <i>(see Part 3 for a description)</i> Alistair Paul Carden 28 Lawford Lane Writtle Chelmsford CM1 3EA <i>(see Part 3 for a description)</i> Jane Elizabeth Collins 28 Lawford Lane Writtle Chelmsford CM1 3EA <i>(see Part 3 for a description)</i> Environment Agency Horizon House Deanery Road Bristol BS1 5AH <i>(see Part 3 for a description)</i> Gail Marie Gardner Spinney House Cow Watering Lane Writtle Chelmsford CM1 3SB <i>(see Part 3 for a description)</i>

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	CATEGORY 1 (A person is within Category 1 if the applicant, after making diligent inquiry, knows that the person is an owner, lessee, tenant (whatever the tenancy period) or occupier of the land)		CATEGORY 2 (A person is within Category 2 if the applicant, after making diligent inquiry, knows that the person (a) is interested in the land, or (b) has power (i) to sell and convey the land, or (ii) to release the land)	
				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F-8/42 (cont'd)							John Ivor Gardner Spinney House Cow Watering Lane Writtle Chelmsford CM1 3SB (see Part 3 for a description) Kevin Frederick Haselgrove 21 Lordship Road Writtle Chelmsford CM1 3EQ (see Part 3 for a description) Rowena June Haselgrove 21 Lordship Road Writtle Chelmsford CM1 3EQ (see Part 3 for a description) Emma Clare Macnamara 32 Victoria Road Writtle Chelmsford CM1 3PA (see Part 3 for a description) John Michael MacNamara 32 Victoria Road Writtle Chelmsford CM1 3PA (see Part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F 8/42 (cont'd)							Northumbrian Water Limited Northumbria House Abbey Road Pity Me Durham DH1 5FJ (see Part 3 for a description) Celia Ann Open 1 Sturgeon Cottages Cowwatering Lane Writtle Chelmsford CM1 3SD (see Part 3 for a description) Robert Open 1 Sturgeon Cottages Cowwatering Lane Writtle Chelmsford CM1 3SD (see Part 3 for a description) Personal Representative to the Estate of Brian Gibson 34 Mayfield Road Writtle Chelmsford CM1 3EL (see Part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F-8/42 (cont'd)							Louise Jane Rawlinson 41 Back Road Writtle Chelmsford CM1 3PD (see Part 3 for a description) Mark Rawlinson 41 Back Road Writtle Chelmsford CM1 3PD (see Part 3 for a description) S E Dunkley (AH) Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG (see Part 3 for a description) S E Dunkley (JS) Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG (see Part 3 for a description) S E Dunkley (KS) Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG (see Part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(a) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009						
Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	CATEGORY 1 (A person is within Category 1 if the applicant, after making diligent inquiry, knows that the person is an owner, lessee, tenant (whatever the tenancy period) or occupier of the land)		CATEGORY 2 (A person is within Category 2 if the applicant, after making diligent inquiry, knows that the person ' (a) is interested in the land, or (b) has power '(i) to sell and convey the land, or (ii) to release the land)
				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers
F-8/42 (cont'd)						Stellar Sixth (Green Nation) Partnership Green Nation The Long Barn Manor Courtyard Stratton-On-The-Fosse Radstock BA3 4QF (see Part 3 for a description) Thatchers Farm Limited Little Thatchers Hoe Street Roxwell Chelmsford CM1 4LX (see Part 3 for a description) The Ashes (Writtle) Limited c/o Essex Properties Limited 11 Reeves Way South Woodham Ferrers Chelmsford CM3 5XF (see Part 3 for a description) The Childcare Corporation Limited Tuscany House White Hart Lane Basingstoke RG21 4AF (see Part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 1: Categories 1 and 2

Book of Reference Part 1 (Section F – Chelmsford City Council and Brentwood Borough Council)							
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Qualifying persons under regulation 7(1)(a) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009							
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				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F-8/42 (cont'd)							The Owner 39 Back Road Writtle Chelmsford CM1 3PD (see Part 3 for a description) Angela Irene Thorpe-Apps Sturgeons House Cow Watering Lane Writtle Chelmsford CM1 3SB (see Part 3 for a description) Philip Lionel Thorpe-Apps Sturgeons House Cow Watering Lane Writtle Chelmsford CM1 3SB (see Part 3 for a description) Paul John Tuckey 1 Lordship Cottages Lordship Road Writtle Chelmsford CM1 3RP (see Part 3 for a description) Nicola Jane Underwood 3 Daws Close Writtle Chelmsford CM1 3PE (see Part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 1: Categories 1 and 2

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				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F 8/42 (cont'd)							Stephen Hilary Underwood 3 Daws Close Writtle Chelmsford CM1 3PE (see Part 3 for a description) Unknown (see Part 3 for a description) Unknown (see Part 3 for a description) Unknown (see Part 3 for a description) Unknown (see Part 3 for a description) Wilkin and Sons Limited Trewlands Farm Factory Hill Tiptree Colchester CO5 0RF (see Part 3 for a description) Martin Paul Wootton 19 Lordship Road Writtle Chelmsford CM1 3EQ (see Part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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				(A person is within Category 1 if the applicant, after making diligent inquiry, knows that the person is an owner, lessee, tenant (whatever the tenancy period) or occupier of the land)			(A person is within Category 2 if the applicant, after making diligent inquiry, knows that the person '(a) is interested in the land, or (b) has power '(i) to sell and convey the land, or (ii) to release the land)
				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F-8/42 (cont'd)							Ruth Diana Wootton 19 Lordship Road Writtle Chelmsford CM1 3EQ (see Part 3 for a description) Barry John Clayden 82 Back Road Writtle Chelmsford CM1 3PD (see Part 3 for a description) Katharine Joy Clayden 82 Back Road Writtle Chelmsford CM1 3PD (see Part 3 for a description) Helen Elizabeth Bradburn 34 Mayfield Road Writtle Chelmsford CM1 3EL (see part 3 for a description) Michael Tyrone Bradburn 34 Mayfield Road Writtle Chelmsford CM1 3EL (see part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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				(A person is within Category 1 if the applicant, after making diligent inquiry, knows that the person is an owner, lessee, tenant (whatever the tenancy period) or occupier of the land)			(A person is within Category 2 if the applicant, after making diligent inquiry, knows that the person (a) is interested in the land, or (b) has power (i) to sell and convey the land, or (ii) to release the land)
				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F 8/42 (cont'd)							Endurance Estates Land Promotion (Writtle) Limited 4 Birchley Industrial Estate Birchfield Lane Oldbury B69 1DT (see part 3 for a description) Endurance Estates Land Promotion Limited 4 Birchley Industrial Estate Birchfield Lane Oldbury B69 1DT (see part 3 for a description) Personal Representative to the Estate of Brian Gibson 34 Mayfield Road Writtle Chelmsford CM1 3EL (see part 3 for a description) The Childcare Corporation Limited Tuscany House White Hart Lane Basingstoke RG21 4AF (see part 3 for a description)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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				Freehold Owners or Reputed Freehold Owners	Lessees or Tenants or Reputed Lessees or Tenants	Occupiers or Reputed Occupiers	
F-8/42 (cont'd)							Aei Solar Limited 20 Central Avenue St. Andrews Business Park Norwich NR7 0HR (see Part 3 for a description)
F-8/43			Number not used				
F-8/44			Number not used				

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 2 Category 3: Section 10 Compulsory Purchase Act 1965, Land Compensation Act 1973 Part 1 or Section 152(3) of Planning Act 2008

Book of Reference Part 2 (Section F – Chelmsford City Council and Brentwood Borough Council)

Part 2: Names and addresses for service of each persons within Category 3 that would or might be entitled to make a relevant claim as defined by Section 57 of the Planning Act 2008

Potential claims under Compulsory Purchase Act 1965 s.10, Land Compensation Act 1973 Part 1 or section 152(3) of the Planning Act 2008

Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Jeremy Mark Alhadeff
Cresseners
Chatham Hall Lane
Great Waltham
Chelmsford
CM3 1BZ
(in plot(s) F-3/116, F-4/1, F-4/2, F-4/3, F-4/4, F-4/6, F-4/9, F-4/16, F-4/17, F-4/19)

Katharine Elizabeth Allan
4 Handley Green Farm Cottage
Handley Green
Ingatestone
CM4 0QB
(in all plots in this Section)
(as riparian owner)

Richard John Allan
4 Handley Green Farm Cottage
Handley Green
Ingatestone
CM4 0QB
(in plot(s) F-10/50, F-10/51, F-10/53, F-10/60, F-10/67 and in all other plots in this Section)

Richard John Allan
4 Handley Green Farm Cottage
Handley Green
Ingatestone
CM4 0QB
(as riparian owner)
(in all plots in this section)

Victoria Anderson
1 Lordship Cottages
Lordship Road
Writtle
Chelmsford
CM1 3RP
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 2 Category 3: Section 10 Compulsory Purchase Act 1965, Land Compensation Act 1973 Part 1 or Section 152(3) of Planning Act 2008

Book of Reference Part 2 (Section F – Chelmsford City Council and Brentwood Borough Council)	
Part 2: Names and addresses for service of each persons within Category 3 that would or might be entitled to make a relevant claim as defined by Section 57 of the Planning Act 2008	
Potential claims under Compulsory Purchase Act 1965 s.10, Land Compensation Act 1973 Part 1 or section 152(3) of the Planning Act 2008	
Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
Harriet Helen Boulding Waltham House Parsonage Lane Howe Street Chelmsford CM3 1BS (in plot(s) F-2/63, F-3/10, F-3/18, F-3/24, F-3/26, F-3/40, F-3/44, F-3/45, F-3/47, F-3/55, F-3/56, F-3/68, F-3/69, F-3/70, F-3/72, F-3/9 and in all other plots in this Section)	
Helen Elizabeth Boulding Waltham House Parsonage Lane Howe Street Chelmsford CM3 1BS (in plot(s) F-2/63, F-3/9, F-3/10, F-3/18, F-3/24, F-3/26, F-3/40, F-3/44, F-3/45, F-3/47, F-3/55, F-3/56, F-3/68, F-3/69, F-3/70, F-3/72 and in all other plots in this Section)	
Joseph William Boulding Park Farm House Pleshey Chelmsford CM3 1JA (in plot(s) F-2/63, F-3/10, F-3/18, F-3/24, F-3/26, F-3/40, F-3/44, F-3/45, F-3/47, F-3/55, F-3/56, F-3/68, F-3/69, F-3/70, F-3/72, F-3/9 and in all other plots in this Section)	
Catherine Ann Bowles 80 Victoria Road Writtle Chelmsford CM1 3PA (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Andrew George Bowman Corner Cottage Larks Lane Great Waltham Chelmsford CM3 1AD (in all plots in this Section)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 2 Category 3: Section 10 Compulsory Purchase Act 1965, Land Compensation Act 1973 Part 1 or Section 152(3) of Planning Act 2008

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Potential claims under Compulsory Purchase Act 1965 s.10, Land Compensation Act 1973 Part 1 or section 152(3) of the Planning Act 2008

Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Joanne Elaine Bowman
Corner Cottage
Larks Lane
Great Waltham
Chelmsford
CM3 1AD
(in all plots in this Section)

Edward Leonard Bradley
The Woodpeckers
Chignal St. James
Chelmsford
CM1 4TZ
(in all plots in this Section)

Brian Kemp Trading Limited
c/o Stellar Asset Management Limited
20 Chapel Street
Liverpool
L3 9AG
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47 and in all other plots in this Section)

British Telecommunications plc
1 Braham Street
London
E1 8EE
(in all plots in this Section)

Harry Frederick David Brown
Ivy Barn Cottage
Ivy Barn Lane
Margaretting
Ingatstone
CM4 0EW
(in all plots in this Section)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 2 Category 3: Section 10 Compulsory Purchase Act 1965, Land Compensation Act 1973 Part 1 or Section 152(3) of Planning Act 2008

Book of Reference Part 2 (Section F – Chelmsford City Council and Brentwood Borough Council)	
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Potential claims under Compulsory Purchase Act 1965 s.10, Land Compensation Act 1973 Part 1 or section 152(3) of the Planning Act 2008	
Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
Cadent Gas Limited Pilot Way Ansty Coventry CV7 9JU (in plot(s) F-5/9, F-5/22, F-5/23, F-5/24, F-5/25, F-5/26, F-5/30, F-6/10, F-6/14, F-6/15, F-6/17, F-6/20, F-7/63, F-7/71, F-7/72, F-7/76, F-8/3, F-8/5, F-8/7, F-8/9, F-8/11, F-8/12, F-8/15, F-8/17, F-8/18, F-8/22, F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/28, F-8/30, F-8/31, F-8/32, F-8/33, F-8/34, F-8/36, F-8/37, F-8/39, F-8/42, F-8/47, F-8/51, F-8/52, F-8/54, F-8/57, F-8/65, F-8/66, F-8/67, F-8/68, F-8/74, F-8/75, F-8/77, F-8/78, F-8/79, F-8/81, F-8/82, F-8/83, F-8/84, F-8/93, F-8/97, F-8/99, F-8/100, F-8/102, F-8/104, F-9/1, F-9/2, F-9/4, F-9/5, F-9/8, F-9/9, F-9/10, F-9/12, F-9/13, F-9/14, F-9/15, F-9/17, F-9/20, F-9/24, F-9/26, F-9/27, F-9/28, F-9/29, F-9/31, F-9/32, F-9/35, F-9/36, F-9/37, F-9/39, F-9/40, F-9/42, F-9/43, F-9/48, F-9/51, F-9/55, F-9/56, F-9/57, F-9/58, F-9/59, F-9/64, F-9/67, F-9/69, F-9/76, F-9/81, F-9/84, F-9/85, F-9/86, F-9/87, F-9/88, F-9/89, F-9/90, F-9/92, F-9/93, F-9/95, F-9/104, F-9/111, F-9/112, F-9/113, F-9/114, F-9/115, F-9/116, F-9/117, F-9/118, F-9/120, F-10/1, F-10/2, F-10/3, F-10/4, F-10/5, F-10/6, F-10/7, F-10/8, F-10/9, F-10/10, F-10/11, F-10/12, F-10/13, F-10/14, F-10/15, F-10/16, F-10/17, F-10/18, F-10/19, F-10/20, F-10/21, F-10/22, F-10/23, F-10/24, F-10/25, F-10/26, F-10/28, F-10/31, F-10/32, F-10/33, F-10/35, F-10/36, F-10/37, F-10/38, F-10/40, F-10/47, F-10/49, F-10/54, F-10/55, F-10/56, F-10/57, F-10/58, F-10/61, F-10/62, F-10/63, F-10/64, F-10/65, F-10/68, F-10/69, F-10/72 and in all other plots in this Section)	
Alistair Paul Carden 28 Lawford Lane Writtle Chelmsford CM1 3EA (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42, F-8/47)	
Personal Representative to the Estate of Gillian Naomi Cater St. James Church The Green Chignal St. James Chelmsford CM1 4TY (in all plots in this Section)	
Chelmsford City Council Civic Centre Duke Street Chelmsford CM1 1JE (in plot(s) F-2/2, F-2/4, F-2/6, F-2/7, F-2/8, F-2/9, F-2/10, F-2/12, F-2/13, F-2/14, F-2/15, F-2/16, F-2/17, F-2/18, F-2/19, F-2/21, F-2/22, F-2/23, F-2/24, F-2/25, F-2/26, F-2/27, F-2/28, F-2/29, F-2/30, F-2/31, F-2/32, F-2/33, F-2/34, F-2/35, F-2/36, F-2/37, F-2/38, F-2/39, F-2/40, F-2/41, F-2/42, F-2/44, F-2/45, F-2/47, F-2/52, F-2/53, F-2/54, F-2/55, F-2/56, F-2/57, F-2/59, F-2/60, F-2/61, F-2/62, F-3/3, F-3/5)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 2 Category 3: Section 10 Compulsory Purchase Act 1965, Land Compensation Act 1973 Part 1 or Section 152(3) of Planning Act 2008

Book of Reference Part 2 (Section F – Chelmsford City Council and Brentwood Borough Council)

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Potential claims under Compulsory Purchase Act 1965 s.10, Land Compensation Act 1973 Part 1 or section 152(3) of the Planning Act 2008

Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Christopher James Childs
127 Lapal
Manor Lane
Halesowen
B62 8QN
(in all plots in this Section)

CJH Holdings Limited
Boyton Hall Farm
Boyton Hall Lane
Roxwell
Chelmsford
CM1 4LN
(in all plots in this Section)

CJH Holdings Limited
Boyton Hall Farm
Boyton Hall Lane
Roxwell
Chelmsford
CM1 4LN
(excluding mines and minerals)
(in all plots in this Section)

Barry John Clayden
82 Back Road
Writtle
Chelmsford
CM1 3PD
in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/27, 8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Katharine Joy Clayden
82 Back Road
Writtle
Chelmsford
CM1 3PD
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, 8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
John Michael Clements Conifers Ongar Road Writtle Chelmsford CM1 3NT (in all plots in this Section)	
Linda Carol Clements Conifers Ongar Road Writtle Chelmsford CM1 3NT (in all plots in this Section)	
Richard Geoffrey Coates Jacobs Cottage Chignal St James Chelmsford CM1 4TZ (in all plots in this Section)	
Fiona Jane Collins Wakerings Farm Leighs Road Little Waltham Chelmsford CM3 3NH (in plot(s) F-2/2, F-2/4, F-2/6, F-2/7, F-2/8, F-2/9, F-2/10, F-2/12, F-2/13, F-2/14, F-2/15, F-2/16, F-2/17, F-2/18, F-2/19, F-2/21, F-2/22, F-2/23, F-2/24, F-2/25, F-2/26, F-2/27, F-2/28, F-2/29, F-2/30, F-2/31, F-2/32, F-2/33, F-2/34, F-2/35, F-2/36, F-2/37, F-2/38, F-2/39, F-2/40, F-2/41, F-2/42, F-2/44, F-2/45, F-2/47, F-2/52, F-2/53, F-2/54, F-2/55, F-2/56, F-2/57, F-2/59, F-2/60, F-2/61, F-2/62, F-3/3, F-3/5)	
Jane Elizabeth Collins 28 Lawford Lane Writtle Chelmsford CM1 3EA (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
Eastern Power Networks plc Newington House 237 Southwark Bridge Road London SE1 6NP (in all plots in this Section)	
Jimmy Joe Edwards Ivy Cottage Bulls Cross Ride Waltham Cross EN7 5HS (in plot(s) F-9/3, F-9/6 and in all other plots in this Section)	
Deborah Jane Elliott Rose Cottage Larks Lane Great Waltham Chelmsford CM3 1AD (in all plots in this Section)	
Jane Suzanne Enever Clovers Victoria Road Writtle Chelmsford CM1 3PB (in all plots in this Section)	
Environment Agency Horizon House Deanery Road Bristol BS1 5AH (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47 and in all other plots in this Section)	

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
Paul Stanley Gannicott 1 Montpeliers Cottages Margaretting Road Writtle Chelmsford CM1 3PJ (in all plots in this Section) (as riparian owner)	
Gardening Express (Europe) Limited 1386 London Road Leigh-On-Sea SS9 2UJ (in all plots in this Section)	
Philip Oliver Gardiner Culvercroft Margaretting Road Writtle Chelmsford CM1 3PJ (in all plots in this Section)	
Sandra Ann Gardiner Culvercroft Margaretting Road Writtle Chelmsford CM1 3PJ (in all plots in this Section)	
Gail Marie Gardner Spinney House Cow Watering Lane Writtle Chelmsford CM1 3SB (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

John Ivor Gardner
Spinney House
Cow Watering Lane
Writtle
Chelmsford
CM1 3SB

(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Lucy Victoria Cornelia Gibson
Langleys
Great Waltham
Chelmsford
CM3 1AH

(as trustee to the Estate of Sarah Caroline Georgiana Micklem)
(in all plots in this Section)

Martin Andrew Gill
1 Lace Cottages
Chelmsford Road
Great Waltham
Chelmsford
CM3 1AE

(in all plots in this Section)

Sarah Jane Gill
1 Lace Cottages
Chelmsford Road
Great Waltham
Chelmsford
CM3 1AE

(in all plots in this Section)

Jay Antony Glennie
3 Sycamore Cottages
Roxwell Road
Writtle
Chelmsford
CM1 3SA

(in all plots in this Section)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
Jane Lesley Hampton Peartree Cottage Braintree Road Little Waltham Chelmsford CM3 3LH (in all plots in this Section)	
Terrance George Hampton Peartree Cottage Braintree Road Little Waltham Chelmsford CM3 3LH (in all plots in this Section)	
Kevin Frederick Haselgrove 21 Lordship Road Writtle Chelmsford CM1 3EQ (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Rowena June Haselgrove 21 Lordship Road Writtle Chelmsford CM1 3EQ (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Carole Ann Hawkins Mead Cottage Broads Green Great Waltham Chelmsford CM3 1DR (in all plots in this Section)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
Luke Somerled Macdonald c/o Birketts LLP Providence House 141-145 Princes Street Ipswich IP1 1QJ (in plot(s) F-9/111, F-9/112, F-9/114, F-9/116, F-9/117, F-9/118, F-9/120, F-10/1, F-10/2, F-10/3, F-10/4, F-10/6, F-10/7, F-10/8, F-10/9, F-10/10, F-10/11, F-10/12, F-10/14, F-10/15, F-10/16, F-10/17, F-10/18, F-10/22, F-10/23, F-10/24, F-10/25, F-10/26, F-10/28, F-10/32, F-10/37, F-10/38, F-10/40 and in all other plots in this Section)	
Emma Clare Macnamara 32 Victoria Road Writtle Chelmsford CM1 3PA (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42, F-8/47)	
John Michael MacNamara 32 Victoria Road Writtle Chelmsford CM1 3PA (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42, F-8/47)	
Mark Archibald Makgill Crichton Maitland Newney Hall Newney Green Chelmsford CM1 3SE (as reputed owner) (in all plots in this Section)	
Mark Archibald Makgill Crichton Maitland Newney Hall Newney Green Chelmsford CM1 3SE (as trustee of the Newney Settlement) (in all plots in this Section)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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National Grid plc 1-3 Strand London WC2N 5EH (in plot(s) F-10/69)	
National Highways Limited Three Snowhill Snow Hill Queensway Birmingham B4 6GA (in all plots in this Section)	
Northumbrian Water Limited Northumbria House Abbey Road Pity Me Durham DH1 5FJ (in plot(s) F-1/20, F-1/23, F-1/28, F-1/71, F-1/73, F-1/74, F-1/79, F-1/88, F-1/92, F-2/2, F-2/4, F-2/5, F-2/6, F-2/7, F-2/8, F-2/9, F-2/10, F-2/12, F-2/13, F-2/14, F-2/15, F-2/16, F-2/17, F-2/18, F-2/19, F-2/21, F-2/22, F-2/23, F-2/24, F-2/25, F-2/26, F-2/27, F-2/28, F-2/29, F-2/30, F-2/31, F-2/32, F-2/33, F-2/34, F-2/35, F-2/36, F-2/37, F-2/38, F-2/39, F-2/40, F-2/41, F-2/42, F-2/44, F-2/45, F-2/47, F-2/52, F-2/53, F-2/54, F-2/55, F-2/56, F-2/57, F-2/59, F-2/60, F-2/61, F-2/62, F-3/3, F-3/5, F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47 and in all other plots in this Section)	
Northumbrian Water Limited Northumbria House Abbey Road Pity Me Durham DH1 5FJ (trading as Essex and Suffolk Water) (in plot(s) F-2/2, F-2/4, F-2/6, F-2/7, F-2/8, F-2/9, F-2/10, F-2/12, F-2/13, F-2/14, F-2/15, F-2/16, F-2/17, F-2/18, F-2/19, F-2/21, F-2/22, F-2/23, F-2/24, F-2/25, F-2/26, F-2/27, F-2/28, F-2/29, F-2/30, F-2/31, F-2/32, F-2/33, F-2/34, F-2/35, F-2/36, F-2/37, F-2/38, F-2/39, F-2/40, F-2/41, F-2/42, F-2/44, F-2/45, F-2/47, F-2/52, F-2/53, F-2/54, F-2/55, F-2/56, F-2/57, F-2/59, F-2/60, F-2/61, F-2/62, F-3/3, F-3/5, F-3/116, F-4/1, F-4/2, F-4/3, F-4/4, F-4/6, F-4/9, F-4/16, F-4/17, F-4/19)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Titus Wole Odedun
28 Lancaster Road
Southport
PR8 2LE
(in all plots in this Section)

On Tower UK 1 Limited
R Plus
4th Floor
2 Blagrove Street
Reading
RG1 1AZ
(in plot(s) F-7/37, F-7/39, F-7/43, F-7/50, F-8/70 and in all other plots in this Section)

On Tower UK Limited
4th Floor
2 Blagrove Street
Reading
RG1 1AZ
(in plot(s) F-8/104, F-9/5, F-9/13, F-9/26, F-9/28, F-9/29, F-9/31, F-9/32, F-9/39)

Celia Ann Open
1 Sturgeon Cottages
Cowwatering Lane
Writtle
Chelmsford
CM1 3SD
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Robert Open
1 Sturgeon Cottages
Cowwatering Lane
Writtle
Chelmsford
CM1 3SD
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
Personal Representative to the Estate of Ann Alhadeff Cresseners Chatham Hall Lane Great Waltham Chelmsford CM3 1BZ (in plot(s) F-3/116, F-4/1, F-4/2, F-4/3, F-4/4, F-4/6, F-4/9, F-4/16, F-4/17, F-4/19)	
Personal Representative to the Estate of Anthony Peter Dobson Bylake Roxwell Boarding Kennels & Cattery Roxwell Road Chelmsford CM1 3SA (in all plots in this Section)	
Personal Representative to the Estate of Brian Gibson 34 Mayfield Road Writtle Chelmsford CM1 3EL (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Personal Representative to the Estate of Michael Claud Stacey Sawyers Partridge Green Broomfield Chelmsford CM1 7EY (in all plots in this Section)	
Personal Representative to the Estate of Norman Herbert Wasteneay Woodhall House Chignal Smealey Chelmsford CM1 4SU (in all plots in this Section)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Part 2: Names and addresses for service of each persons within Category 3 that would or might be entitled to make a relevant claim as defined by Section 57 of the Planning Act 2008

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Faye Louise Pryor
Ivy Barn Cottage
Ivy Barn Lane
Margaretting
Ingatestone
CM4 0EW
(in all plots in this Section)

Karen Pym
Range Cottage
Ongar Road
Writtle
Chelmsford
CM1 3NT
(in all plots in this Section)

Usha Rao
Marshalls Farm
Handley Green
Ingatestone
CM4 0QB
(in all plots in this Section)

Louise Jane Rawlinson
41 Back Road
Writtle
Chelmsford
CM1 3PD
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Mark Rawlinson
41 Back Road
Writtle
Chelmsford
CM1 3PD
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 2 Category 3: Section 10 Compulsory Purchase Act 1965, Land Compensation Act 1973 Part 1 or Section 152(3) of Planning Act 2008

Book of Reference Part 2 (Section F – Chelmsford City Council and Brentwood Borough Council)

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Potential claims under Compulsory Purchase Act 1965 s.10, Land Compensation Act 1973 Part 1 or section 152(3) of the Planning Act 2008

Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Samantha Jane Roberts
Larks Lodge
Larks Lane
Great Waltham
Chelmsford
CM3 1AD
(in all plots in this Section)

Robian Restaurants Limited
Harbour Court
Margaretting
Ivy Barn Lane
Portsmouth
PO6 4ST
(in all plots in this Section)

Amanda Jane Ruffell
Longs Barn
Longs Lane
Little Waltham
Chelmsford
CM3 3NJ
(in plot(s) F-2/2, F-2/4, F-2/6, F-2/7, F-2/8, F-2/9, F-2/10, F-2/12, F-2/13, F-2/14, F-2/15, F-2/16, F-2/17, F-2/18, F-2/19, F-2/21, F-2/22, F-2/23, F-2/24, F-2/25, F-2/26, F-2/27, F-2/28, F-2/29, F-2/30, F-2/31, F-2/32, F-2/33, F-2/34, F-2/35, F-2/36, F-2/37, F-2/38, F-2/39, F-2/40, F-2/41, F-2/42, F-2/44, F-2/45, F-2/47, F-2/52, F-2/53, F-2/54, F-2/55, F-2/56, F-2/57, F-2/59, F-2/60, F-2/61, F-2/62, F-3/3, F-3/5)

James Edward Ruffell
Longs Barn
Longs Lane
Little Waltham
Chelmsford
CM3 3NJ
(in plot(s) F-2/2, F-2/4, F-2/6, F-2/7, F-2/8, F-2/9, F-2/10, F-2/12, F-2/13, F-2/14, F-2/15, F-2/16, F-2/17, F-2/18, F-2/19, F-2/21, F-2/22, F-2/23, F-2/24, F-2/25, F-2/26, F-2/27, F-2/28, F-2/29, F-2/30, F-2/31, F-2/32, F-2/33, F-2/34, F-2/35, F-2/36, F-2/37, F-2/38, F-2/39, F-2/40, F-2/41, F-2/42, F-2/44, F-2/45, F-2/47, F-2/52, F-2/53, F-2/54, F-2/55, F-2/56, F-2/57, F-2/59, F-2/60, F-2/61, F-2/62, F-3/3, F-3/5)

S E Dunkley (AH) Trading Limited
c/o Stellar Asset Management Limited
20 Chapel Street
Liverpool
L3 9AG
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47 and in all other plots in this Section)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 2 Category 3: Section 10 Compulsory Purchase Act 1965, Land Compensation Act 1973 Part 1 or Section 152(3) of Planning Act 2008

Book of Reference Part 2 (Section F – Chelmsford City Council and Brentwood Borough Council)
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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009
S E Dunkley (JS) Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42, F-8/47 and in all other plots in this Section)
S E Dunkley (KS) Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42, F-8/47 and in all other plots in this Section)
S J R Farming Limited Office 6e Dollymans Farm Doublegate Lane Rawreth Wickford SS11 8UD (in plot(s) F-3/25, F-3/58, F-3/59, F-3/62, F-3/84, F-3/89, F-3/98, F-3/99, F-3/100, F-3/101, F-3/103, F-3/104)
Simon Charles Sampson Langleys Great Waltham Chelmsford CM3 1AH <i>(as trustee to the Estate of Sarah Caroline Georgiana Micklem)</i> (in all plots in this Section)
James Scott 1 Greens Cottages Ivy Barn Lane Margaretting Ingatstone CM4 0EW (in all plots in this Section)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Stellar Sixth (Green Nation) Partnership

Green Nation

The Long Barn

Manor Courtyard

Stratton-On-The-Fosse

Radstock

BA3 4QF

(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Peter Stevens

Four Oaks

Ivy Barn Lane

Margaretting

Ingatestone

CM4 0EW

(in all plots in this Section)

(as riparian owner)

Jenny Helen Anne Stokes

Belsmard

Nathans Lane

Writtle

Chelmsford

CM1 3RF

(in all plots in this Section)

Colin Mark Straus

Bush House

300 Ongar Road

Writtle

Chelmsford

CM1 3NZ

(in all plots in this Section)

Martin Strube

Grassroots House

59-61 Abington Avenue

Northampton

NN1 4PB

(in all plots in this Section)

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

James Tayler
7 Hurstwood Court
15 Hall Lane
Upminster
RM14 1BB
(in all plots in this Section)

Telefonica O2 UK Limited
Highdown House
Yeoman Way
Slough
BN99 3HH
(in plot(s) F-7/17, F-7/18)

Templant Hire Limited
High Road
Thornwood Common
Epping
CM16 6LU(in all plots in this Section)

Thatchers Farm Limited
Little Thatchers
Hoe Street
Roxwell
Chelmsford
CM1 4LX
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47 and in all other plots in this Section)

Thatchers Farm Limited
Little Thatchers
Hoe Street
Roxwell
Chelmsford
CM1 4LX
(as reputed owner)
(in all plots in this Section)

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Thatchers Farm Limited
Little Thatchers
Hoe Street
Roxwell
Chelmsford
CM1 4LX
(as riparian owner)
(in all plots in this Section)

The Ashes (Writtle) Limited
c/o Essex Properties Limited
11 Reeves Way
South Woodham Ferrers
Chelmsford
CM3 5XF
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

The Chelmsford Diocesan Board of Finance
53 New Street
Chelmsford
CM1 1AT
(in plot(s) F-1/12, F-1/14, F-1/18, F-1/26, F-1/29, F-1/31, F-1/32, F-1/33, F-1/34, F-1/35, F-1/36, F-1/38, F-1/39, F-1/40, F-1/42, F-2/1, F-2/3 and in all other plots in this Section)

The Childcare Corporation Limited
Tuscany House
White Hart Lane
Basingstoke
RG21 4AF
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

The King Edward VI'S Grammar School At Chelmsford Foundation
King Edward VI Grammar School
Broomfield Road
Chelmsford
CM1 3SX
(in all plots in this Section)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
The Occupier The Chalet Roxwell Road Writtle Chelmsford CM1 3SA (in all plots in this Section)	
The Occupier Bylake Roxwell Boarding Kennels & Cattery Roxwell Road Writtle Chelmsford CM1 3SA (in all plots in this Section)	
The Occupier Little Paddocks Highwood Road Writtle Chelmsford CM1 3PR (in all plots in this Section)	
The Occupier Scravels Cottage Hollows Lane Broomfield CM1 7HH (in all plots in this Section)	
The Owner 39 Back Road Writtle Chelmsford CM1 3PD (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Simon Samuel Kim Thorogood
Hicks Farm Rose Green
Assington
Colchester
CO6 3NB
(trading as S. Thorogood & Sons (Writtle))
(in all plots in this Section)

Angela Irene Thorpe-Apps
Sturgeons House
Cow Watering Lane
Writtle
Chelmsford
CM1 3SB
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Philip Lionel Thorpe-Apps
Sturgeons House
Cow Watering Lane
Writtle
Chelmsford
CM1 3SB
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Henry Thomas Tinney
Housham Hall
Harlow Road
Matching Tye
Harlow
CM17 0PB
(as riparian owner)
(in all plots in this Section)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Peter Tubby Brettons Mashbury Road Chignal St. James Chelmsford CM1 4UA (in all plots in this Section)	
Paul John Tuckey 1 Lordship Cottages Lordship Road Writtle Chelmsford CM1 3RP (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42, F-8/47)	
John Jolliffe Tufnell South House South Street Great Waltham Chelmsford CM3 1DP (in plot(s) F-3/116, F-4/1, F-4/2, F-4/3, F-4/4, F-4/6, F-4/9, F-4/16, F-4/17, F-4/19)	
Tyercroft Limited 33 Millfields Writtle Chelmsford CM1 3LP (in plot(s) F-7/17, F-7/18)	
UK Power Networks (Operations) Limited Newington House 237 Southwark Bridge Road London SE1 6NP (in plot(s) F-3/25, F-3/58, F-3/59, F-3/62, F-3/84, F-3/89, F-3/98, F-3/99, F-3/100, F-3/101, F-3/103, F-3/104, F-8/74, F-8/75, F-8/77, F-8/78, F-8/81, F-8/93, F-8/97, F-8/99, F-8/100, F-8/102, F-9/1, F-9/4, F-9/8, F-9/9, F-9/10, F-9/12, F-9/14, F-9/15, F-9/17, F-9/27 and in all other plots in this Section)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Nicola Jane Underwood
3 Daws Close
Writtle
Chelmsford
CM1 3PE

(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Stephen Hilary Underwood
3 Daws Close
Writtle
Chelmsford
CM1 3PE

(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Unknown
(in all plots in this Section)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

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Alan David Wilde Halfway House Highwood Road Writtle Chelmsford CM1 3PS (in plot(s) F-9/2, F-9/20, F-9/24, F-9/35, F-9/36, F-9/37 and in all other plots in this Section)	
Jacqueline Wilde Halfway House Highwood Road Writtle Chelmsford CM1 3PS (in plot(s) F-9/2, F-9/20, F-9/24, F-9/35, F-9/36, F-9/37 and in all other plots in this Section)	
Wilkin and Sons Limited Trewlands Farm Factory Hill Tiptree Colchester CO5 0RF (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42, F-8/47)	
Personal Representative to the Estate of David John Williams 13 Middlewood Cottages Offton Ipswich IP8 4PR (in all plots in this Section)	
Personal Representative to the Estate of Margaret Elizabeth Williams Adare Chignal St James Chelmsford CM1 4TZ (in all plots in this Section)	

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Woodland Investment Management Limited 19 Half Moon Lane London SE24 9JU (in all plots in this Section)	
Martin Paul Wootton 19 Lordship Road Writtle Chelmsford CM1 3EQ (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Ruth Diana Wootton 19 Lordship Road Writtle Chelmsford CM1 3EQ (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Jane Howie Wreathall Old Barns The Tye Margaretting Ingatestone CM4 9JU (in plot(s) F-10/50, F-10/51, F-10/53, F-10/54, F-10/55, F-10/56, F-10/64, F-10/69, F-10/72 and in all other plots in this Section)	
William Patrick Wreathall 46 Avenue Road Chelmsford CM2 9TY (in all plots in this Section)	

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Timothy Edward John Jones Bess Boro Brinkley Road Westley Waterless Newmarket CB8 0RD (in plot(s) F-3/14, F-3/20, F-3/27, F-3/52, F-3/54, F3/64, F-3/74)	
Adam Paul Heminsley Manor Cottage Roxwell Road Writtle Chelmsford CM1 3RZ (in plot(s) F-7/17, F-7/18)	
Aei Solar Limited 20 Central Avenue St. Andrews Business Park Norwich NR7 0HR in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/27, 8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42, F-8/47)	
Julia Elizabeth Heminsley-Taylor Manor Cottage Roxwell Road Writtle Chelmsford CM1 3RZ in plot(s) F-7/17, F-7/18	
Telefonica O2 UK Limited Highdown House Yeoman Way Slough BN99 3HH in plot(s) F-7/17, F-7/18	

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Beyond Clicks Limited 146 High Street Billericay CM12 9DF (in plot(s) F-10/10, F-10/17)	
Helen Elizabeth Bradburn 34 Mayfield Road Writtle Chelmsford CM1 3EL (as reputed owner) (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Michael Tyrone Bradburn 34 Mayfield Road Writtle Chelmsford CM1 3EL (as reputed owner) (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Jason Jonothan William Bright Peartree Cottage Braintree Road Little Waltham Chelmsford CM3 3LH (in all plots in this Section)	
Charles Humphreys & Sons Limited Blixes Farm Fairstead Chelmsford CM3 2BH (in all plots in this Section)	

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Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009	
Endurance Estates Land Promotion (Writtle) Limited 4 Birchfield Lane Oldbury B69 1DT (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
Endurance Estates Land Promotion Limited 4 Birchley Estate Birchfield Lane Oldbury B69 1DT (in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, F-8/42 , F-8/47)	
David John Evans Woodside 36 Sundridge Avenue Bromley BR1 2QD (in all plots in this Section)	
Mark Albert Evans The Elms Nathans Lane Writtle Chelmsford CM1 3RF (in all plots in this Section)	
Exolum Pipeline System Ltd PO Box 7273 Ashby-De-La-Zouch LE65 2UZ (in plot(s) F-9/25)	

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 2 Category 3: Section 10 Compulsory Purchase Act 1965, Land Compensation Act 1973 Part 1 or Section 152(3) of Planning Act 2008

Book of Reference Part 2 (Section F – Chelmsford City Council and Brentwood Borough Council)

Part 2: Names and addresses for service of each persons within Category 3 that would or might be entitled to make a relevant claim as defined by Section 57 of the Planning Act 2008

Potential claims under Compulsory Purchase Act 1965 s.10, Land Compensation Act 1973 Part 1 or section 152(3) of the Planning Act 2008

Qualifying persons under regulation 7(1)(b) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

South Eastern Power Networks plc
Newington House
237 Southwark Bridge Road
London
SE1 6NP
(in plot(s) F-5/55)

Stays Accommodation Limited
120 Absolute House
Coptfold Hall Farm
Writtle Road
Margaretting
Ingatestone
CM4 0EL
(in plot(s) F-10/10, F-10/17)

Telefonica UK Limited
500 Brook Drive
Reading
RG2 6UU
(in plot(s) F-7/17, F-7/18)

The Childcare Corporation Limited
Tuscany House
White Hart Lane
Basingstoke
RG21 4AF
(in plot(s) F-8/23, F-8/24, F-8/25, F-8/26, F-8/27, F-8/29, F-8/30, F-8/32, F-8/33, F-8/36, F-8/37, ~~F-8/42~~, F-8/47)

Turner Digital Limited
28 Heycroft Way
Chelmsford
CM2 8JG
(in plot(s) F-10/10, F-10/17)

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

Book of Reference Part 3 (Section F – Chelmsford City Council and Brentwood Borough Council)					
Part 3: Names and addresses of those persons whose entitlement to enjoy private easements or rights may be extinguished, suspended or interfered with					
Qualifying persons under regulation 7(1)(c) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009					
Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F-8/42	7	0	2,895 square metres, or thereabouts, of agricultural land, college, path and overhead electricity distribution lines situated at Writtle College, Chelmsford	Victoria Anderson 1 Lordship Cottages Lordship Road Writtle Chelmsford CM1 3RP Aei Solar Limited 20 Central Avenue St. Andrews Business Park Norwich NR7 0HR Catherine Ann Bowles 80 Victoria Road Writtle Chelmsford CM1 3PA Brian Kemp Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG Cadent Gas Limited Pilot Way Ansty Coventry CV7 9JU Alistair Paul Carden 28 Lawford Lane Writtle Chelmsford CM1 3EA	Rights as contained in a Transfer dated 22 June 2021 Rights as contained in a Lease dated 21 July 2017 Rights as contained in a Transfer dated 30 November 2001 Rights as contained in a Lease dated 12 April 2017 Rights as contained in a Deed of Grant dated 20 April 1971 Rights as contained in a Transfer dated 11 August 1999

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

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Part 3: Names and addresses of those persons whose entitlement to enjoy private easements or rights may be extinguished, suspended or interfered with					
Qualifying persons under regulation 7(1)(c) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009					
Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F-8/42 (cont'd)				Jane Elizabeth Collins 28 Lawford Lane Writtle Chelmsford CM1 3EA Environment Agency Horizon House Deanery Road Bristol BS1 5AH Gail Marie Gardner Spinney House Cow Watering Lane Writtle Chelmsford CM1 3SB John Ivor Gardner Spinney House Cow Watering Lane Writtle Chelmsford CM1 3SB Kevin Frederick Haselgrove 21 Lordship Road Writtle Chelmsford CM1 3EQ Rowena June Haselgrove 21 Lordship Road Writtle Chelmsford CM1 3EQ	Rights as contained in a Transfer dated 11 August 1999 Rights as contained in a Lease dated 16 November 2002 Rights as contained in a Transfer dated 10 July 2008 Rights as contained in a Transfer dated 10 July 2008 Rights as contained in a Transfer dated 26 November 1999 Rights as contained in a Transfer dated 26 November 1999

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

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Qualifying persons under regulation 7(1)(c) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009					
Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F 8/42 (cont'd)				Emma Clare Macnamara 32 Victoria Road Writtle Chelmsford CM1 3PA John Michael MacNamara 32 Victoria Road Writtle Chelmsford CM1 3PA Northumbrian Water Limited Northumbria House Abbey Road Pity Me Durham DH1 5FJ Celia Ann Open 1 Sturgeon Cottages Cowwatering Lane Writtle Chelmsford CM1 3SD Robert Open 1 Sturgeon Cottages Cowwatering Lane Writtle Chelmsford CM1 3SD	Rights as contained in a Transfer dated 15 December 2016 Rights as contained in a Transfer dated 15 December 2016 Rights as contained in a Deed of Grant dated 3 February 1984 Rights as contained in a Transfer dated 31 May 2011 Rights as contained in a Transfer dated 31 May 2011

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

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Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F 8/42 (cont'd)				Personal Representative to the Estate of Brian Gibson 34 Mayfield Road Writtle Chelmsford CM1 3EL Louise Jane Rawlinson 41 Back Road Writtle Chelmsford CM1 3PD Mark Rawlinson 41 Back Road Writtle Chelmsford CM1 3PD S E Dunkley (AH) Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG S E Dunkley (JS) Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG S E Dunkley (KS) Trading Limited c/o Stellar Asset Management Limited 20 Chapel Street Liverpool L3 9AG	Rights as contained in a Transfer dated 11 October 2002 Rights as contained in a Transfer dated 14 January 2000 Rights as contained in a Transfer dated 14 January 2000 Rights as contained in a Lease dated 12 April 2017 Rights as contained in a Lease dated 12 April 2017 Rights as contained in a Lease dated 12 April 2017

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

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Part 3: Names and addresses of those persons whose entitlement to enjoy private easements or rights may be extinguished, suspended or interfered with					
Qualifying persons under regulation 7(1)(c) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009					
Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F-8/42 (cont'd)				Stellar Sixth (Green Nation) Partnership Green Nation The Long Barn Manor Courtyard Stratton-On-The-Fosse Radstock BA3 4QF Thatchers Farm Limited Little Thatchers Hoe Street Roxwell Chelmsford CM1 4LX The Ashes (Writtle) Limited c/o Essex Properties Limited 11 Reeves Way South Woodham Ferrers Chelmsford CM3 5XF The Childcare Corporation Limited Tuscany House White Hart Lane Basingstoke RG21 4AF The Owner 39 Back Road Writtle Chelmsford CM1 3PD	Rights as contained in a Lease dated 12 April 2017 Rights as contained in a Lease dated 21 July 2017 Rights as contained in a Transfer dated 19 August 2021 Rights as contained in a Transfer dated 24 January 2020 Rights as contained in a Transfer dated 11 December 2017 Rights as contained in a Lease dated 20 April 2001 Rights as contained in a Transfer dated 25 February 2000

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

Book of Reference Part 3 (Section F – Chelmsford City Council and Brentwood Borough Council)					
Part 3: Names and addresses of those persons whose entitlement to enjoy private easements or rights may be extinguished, suspended or interfered with					
Qualifying persons under regulation 7(1)(c) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009					
Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F 8/42 (cont'd)				Angela Irene Thorpe-Apps Sturgeons House Cow Watering Lane Writtle Chelmsford CM1 3SB Philip Lionel Thorpe-Apps Sturgeons House Cow Watering Lane Writtle Chelmsford CM1 3SB Paul John Tuckey 1 Lordship Cottages Lordship Road Writtle Chelmsford CM1 3RP Nicola Jane Underwood 3 Daws Close Writtle Chelmsford CM1 3PE Stephen Hilary Underwood 3 Daws Close Writtle Chelmsford CM1 3PE Unknown	Rights as contained in a Transfer dated 27 April 2007 Rights as contained in a Transfer dated 27 April 2007 Rights as contained in a Transfer dated 22 June 2021 Rights as contained in a Transfer dated 15 December 2016 Rights as contained in a Transfer dated 15 December 2016 Rights as contained in a Transfer dated 7 February 2017

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

Book of Reference Part 3 (Section F – Chelmsford City Council and Brentwood Borough Council)

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Qualifying persons under regulation 7(1)(c) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F 8/42 (cont'd)				Unknown	Rights as contained in a Transfer dated 4 August 2020
				Unknown	Rights as contained in a Deed of Grant dated 29 April 2002
				Unknown	Restrictive covenants as contained in a Deed of Grant dated 7 February 2017
				Wilkin and Sons Limited Trewlands Farm Factory Hill Tiptree Colchester CO5 0RF	Rights as contained in a Lease dated 26 September 2011
				Martin Paul Wootton 19 Lordship Road Writtle Chelmsford CM1 3EQ	Rights as contained in a Transfer dated 19 January 2001
				Ruth Diana Wootton 19 Lordship Road Writtle Chelmsford CM1 3EQ	Rights as contained in a Transfer dated 19 January 2001
				Barry John Clayden 82 Back Road Writtle Chelmsford CM1 3PD	Rights as contained in a Transfer dated 1 December 2017

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

Book of Reference Part 3 (Section F – Chelmsford City Council and Brentwood Borough Council)

Part 3: Names and addresses of those persons whose entitlement to enjoy private easements or rights may be extinguished, suspended or interfered with

Qualifying persons under regulation 7(1)(c) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F-8/42 (cont'd)				Katharine Joy Clayden 82 Back Road Writtle Chelmsford CM1 3PD Helen Elizabeth Bradburn 34 Mayfield Road Writtle Chelmsford CM1 3EL (as reputed owner) Michael Tyrone Bradburn 34 Mayfield Road Writtle Chelmsford CM1 3EL (as reputed owner) Endurance Estates Land Promotion (Writtle) Limited 4 Birchley Industrial Estate Birchfield Lane Oldbury B69 1DT Endurance Estates Land Promotion Limited 4 Birchley Industrial Estate Birchfield Lane Oldbury B69 1DT Personal Representative to the Estate of Brian Gibson 34 Mayfield Road Writtle Chelmsford CM1 3EL	Rights as contained in a Transfer dated 1 December 2017 Rights as contained in a Transfer dated 11 October 2002 Rights as contained in a Transfer dated 11 October 2002 Restriction against the disposition of part of the registered estate without a signed certificate that the provisions of clause 4.2(b) of a Promotion and Option Agreement dated 28 July 2022 have been complied with or do not apply to the disposition Restriction against the disposition of part of the registered estate without a signed certificate that the provisions of clause 4.2(b) of a Promotion and Option Agreement dated 28 July 2022 have been complied with or do not apply to the disposition Rights as contained in a Transfer dated 11 October 2002

THE NATIONAL GRID (NORWICH TO TILBURY) ORDER

Part 3: Easements or other private rights proposed to be interfered with, suspended or extinguished

Book of Reference Part 3 (Section F – Chelmsford City Council and Brentwood Borough Council)					
Part 3: Names and addresses of those persons whose entitlement to enjoy private easements or rights may be extinguished, suspended or interfered with					
Qualifying persons under regulation 7(1)(c) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009					
Plot Number on Land Plans	Class of Interest or right to be acquired or power to be used – NG	Class of Interest or right to be acquired or power to be used – UKPN	Description of Land	Names Of All Those Entitled To Enjoy Easements Or Other Private Rights Over Land (Including Private Rights Of Navigation Over Water) Which It Is Proposed Shall Be Extinguished, Suspended Or Interfered With	Description of the right for which person in adjoining column might be entitled to make claim
F-8/42 (cont'd)				The Childcare Corporation Limited Tuscany House White Hart Lane Basingstoke RG21 4AF	Rights as contained in a Lease dated 20 April 2001