

Norfolk Boreas Offshore Wind Farm

Appendix 22.3

Water Vole Survey Reports

Environmental Statement

Volume 3

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Norfolk Boreas Offshore Wind Farm

Water Vole Survey Report

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Glossary of Acronyms

AfL	Agreement for Lease
CIEEM	Chartered Institute of Ecology and Environmental Management
DCO	Development Consent Order
EAOW	East Anglia Offshore Wind
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
HDD	Horizontal Directional Drilling
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IEMA	Institute of Environmental Assessment
kV	Kilovolts
NSIP	Nationally Significant Infrastructure Project
PEIR	Preliminary Environmental Information Report
RHB	Right hand bank
SPR	Scottish Power Renewables (UK) Limited
UK BAP	UK Biodiversity Action Plan
VWPL	Vattenfall Wind Power Ltd
ZDA	Zone Development Agreement

Glossary of Terminology

Landfall	Where the offshore cables come ashore at Happisburgh South
Mobilisation area	Areas approx. 100 x 100m used as access points to the running track for duct installation. Required to store equipment and provide welfare facilities. Located adjacent to the onshore cable route, accessible from local highways network suitable for the delivery of heavy and oversized materials and equipment.
Mobilisation zone	Area within which a mobilisation area will be located.
National Grid overhead line temporary works	Area within which the work will be undertaken to complete the necessary modification to the existing 400kV overhead lines.
National Grid substation extension	The permanent footprint of the National Grid substation extension.
Necton National Grid substation	The grid connection location for Norfolk Boreas and Norfolk Vanguard
National Grid temporary works	Land adjacent to the Necton National Grid substation which would be temporarily required during construction of the National Grid substation extension.
Onshore cable route	The up to 35m working width within a 45m wide corridor which will contain the buried export cables as well as the temporary running track, topsoil storage and excavated material during construction.
Onshore cables	The cables which take power and communications from landfall to the onshore project substation
Onshore project area	The area of the onshore infrastructure (landfall, onshore cable route, accesses, trenchless crossing zones and mobilisation areas; onshore project substation

	and extension to the Necton National Grid substation and overhead line modifications).
Onshore project substation	A compound containing electrical equipment to enable connection to the National Grid. The substation will convert the exported power from HVDC to HVAC, to 400kV (grid voltage). This also contains equipment to help maintain stable grid voltage.
Onshore Infrastructure	The combined name for all onshore infrastructure associated with the project from landfall to grid connection.
The project	Norfolk Boreas Wind Farm including the onshore and offshore infrastructure.

1 Introduction

1. The aim of this report is to present the findings of a water vole *Arvicola amphibius* presence/absence survey (herein the '2018 Water Vole Survey') conducted with respect to the Norfolk Boreas Offshore Wind Farm (herein referred to as the 'project') onshore project area.
2. The results of this survey are also informed by the findings from the 2017 Water Vole Survey which was conducted for Norfolk Vanguard (Norfolk Boreas' sister project) in 2017. Details with respect to the two surveys have been included throughout the report.

1.1 Project Background

3. The Norfolk Boreas Offshore Wind Farm site is located 73km, at the closest point, off the coast of Norfolk within which wind turbines will be located. The project would comprise an array of offshore wind turbines and offshore substations which will be connected to the shore by offshore export cables.
4. The project will also require onshore infrastructure in order to transmit and connect the offshore wind farm to the National Grid, which in summary would comprise:
 - Landfall;
 - Onshore cable route (60km);
 - An onshore project substation; and
 - Works at the Necton National Grid substation (including extension of the existing substation, interface cables, and modification of the overhead powerlines).
5. Norfolk Boreas is the sister project to the proposed Norfolk Vanguard offshore wind farm project which will be located across two offshore wind farm sites, adjacent to the Norfolk Boreas offshore wind farm site. Norfolk Vanguard is being developed first and its EIA and project design development are at a more advanced stage than for Norfolk Boreas. As both projects would connect to the existing Necton National Grid substation, there has been a strategic approach to identifying locations for all onshore infrastructure with the aim of optimising overall design and reducing impacts where practical.
6. Please refer to Chapter 5, Project Description for further details regarding the project background on the project.

1.2 Purpose and Scope of this Report

7. A total of two Phase 1 Habitat Surveys were undertaken in 2017 and 2018; the results of which have been used to inform the baseline and scope of this survey report.

8. The results of the 2017 survey were undertaken for Norfolk Vanguard, however are relevant to this assessment owing to the co-location of the export infrastructure for Norfolk Vanguard and Norfolk Boreas (Section 1.1).
9. The data and results of this survey have been supplemented by the 2018 'Extended Phase 1 Habitat Survey' undertaken for Norfolk Boreas. Together, the results assist in providing an overall understanding of the existing water vole presence within the priority watercourses of the onshore project area and therefore both reports should be read in conjunction with one another.

1.2.1 2017 Phase 1 Habitat Survey (Norfolk Vanguard)

10. An Extended Phase 1 Habitat Survey for Norfolk Vanguard was undertaken by Royal HaskoningDHV ecologists during February and March 2017 (the '2017 Extended Phase 1 Habitat Survey') (Royal HaskoningDHV, 2017a). The findings of this survey are reported in Appendix 22.4.
11. During the 2017 Extended Phase 1 Habitat Survey a total of 38 watercourses were preliminarily assessed for their potential to support water voles. Of these, 31 were assessed as being optimal habitat, and the remaining seven were assessed as being sub-optimal. The locations of these watercourses can be seen on Figure 22.3.3, Annex A: Figures and plates of these waterbodies are shown in Annex G: Plates in Appendix 22.4.
12. Sub-optimal water bodies are typically those with artificial banks, strong evidence of pollution, those which no longer support running water in any season, or where field signs of mink have been observed during the survey (Strachan, Moorhouse and Gelling, 2011). Those watercourses assessed as being sub-optimal have been excluded from any further surveys and/or assessment.
13. The 2017 Water Vole Survey included the 31 watercourses scoped in during the 2017 Extended Phase 1 Habitat Survey, plus two watercourses that previously couldn't be accessed due to landowner restrictions, resulting in a total of 33 watercourses scoped into the 2017 Water Vole Survey.

1.2.2 Scope of the 2018 Water Vole Survey

14. The 2017 Extended Phase 1 Habitat Survey and the 2017 Water Vole Survey achieved survey coverage of approximately 50% of the Norfolk Boreas onshore project area. Surveys were not possible for the remainder of the onshore project area in 2017 due to landowner access restrictions. In order to ensure that, as far as possible, the 2018 survey effort addresses key data gaps identified within the dataset collected during 2017, it was proposed in the Norfolk Boreas Evidence Plan Process (EPP) that surveys would focus on a series of ecological 'priority areas' within

the unsurveyed sections of the onshore project area. These priority areas are shown in Annex A: Figures, Appendix 22.4. Each priority area focuses on a part of the onshore project area where either:

- the onshore project area at this location is anticipated to give rise to effects of a greater magnitude than in other areas, or
 - the area may be ecologically sensitive due to the presence of sensitive habitats, as identified using available desk-based information.
15. The 2018 Extended Phase 1 Habitat Survey included surveys of 15 ecological priority areas. During the 2018 Extended Phase 1 Habitat Survey, 21 watercourses were assessed for their potential to support water voles. Of these watercourses, 17 were identified as being of optimal habitat, whilst three were assessed as being sub-optimal, with one watercourse located outside of the study survey area (see below) and not considered further (please see Appendix 22.4 for further details). The scope of the 2018 Water Vole Survey includes the 17 watercourses within the priority areas assessed as being of optimal habitat for water voles.
16. This Appendix presents the findings of the 2018 Water Vole Survey of these 17 watercourses conducted by Royal HaskoningDHV ecologists in April 2018.
17. This report has been prepared in line with the guidelines as set out in the Chartered Institute of Ecology and Environmental Management's (CIEEM) Guidelines on Ecological Report Writing (2nd Edition, December 2015).

1.2.3 Combined 2017 and 2018 Water Vole Survey results

18. A summary of the combined results of the 2017 and 2018 Water Vole Surveys is also provided within this Appendix. These combined results form the baseline of this assessment. This data will be used to inform the ongoing EIA process for the project and to identify any outline mitigation measures and licensing requirements which may be required.
19. During the 2017 survey, a total of 33 watercourses were surveyed, and during the 2018 survey, a total of 17. Therefore, over the two years a total of 50 individual watercourses were surveyed for the presence/absence of water voles.

1.2.4 Consultation

20. The methodology set out in this report is consistent with that detailed in the 2017 Water Vole Survey Report (Royal HaskoningDHV, 2017b). As part of the project EPP, the methodology proposed for the 2017 Water Vole Survey was issued on 17th March 2017, to the following stakeholders for comment:

- Natural England;

- Environment Agency;
 - Breckland Council;
 - Norfolk County Council; and
 - Norfolk Wildlife Trust.
21. Feedback was received from Norfolk County Council and Natural England on the 23rd March 2017 and 3rd April 2017 confirming that the methodology and approach to surveys was appropriate and acceptable.
22. As part of the Norfolk Boreas EPP, the scope of the surveys presented in this report were issued to the Norfolk Boreas Expert Topic Group (ETG) in January / February 2018. Natural England subsequently confirmed agreement with the scope of the 2018 Water Vole Survey for Norfolk Boreas.

2 Legislation and Policy

23. Table 2.1 summarises the relevant information regarding the legal protection afforded to water voles. However, it should be noted that this is for information only and is not intended to be comprehensive or to replace specialised legal advice.

Table 2.1 Summary of the key legislation and policy relevant to water voles

Legislation	Relevance
Wildlife and Countryside Act 1981 (as amended)	This Act makes it an offence to intentionally kill, injure or take any animal listed in Schedule 5 of the Act and protects occupied and unoccupied places used for shelter or protection. Water voles are listed on Schedule 5.
Natural Environment and Rural Communities Act 2006	Section 41 of the Act requires the Secretary of State to compile a list of habitats and species of principal importance for the conservation of biodiversity in England. Decision makers of public bodies, in the execution of their duties, must have regard to the conservation of biodiversity in England, and the list is intended to guide them. Natural England have compiled a list of species of Principal Importance. Water voles are on this list.
Policy	Relevance
UK Post-2010 Biodiversity Framework	Supersedes the UK Biodiversity Action Plan (UK BAP), which fulfilled legal obligation under the Convention on Biological Diversity to identify and produce action plans for produce priority habitats and species.

3 Methodology

3.1 Survey Area

24. The scope of the 2018 Water Vole Survey included all 17 watercourses identified during the 2018 Extended Phase 1 Habitat Survey as being optimal habitat for supporting water voles.

25. The survey area for each watercourse included the extent within the onshore project area plus a 50m buffer upstream and downstream. Collectively, the survey areas for each watercourse are referred to as the '2018 survey area' (as shown on Figure 22.3.2, Annex A: Figures).

3.2 Survey Methodology

26. The 2018 Water Vole Survey was undertaken on the 23rd April and 24th April 2018.
27. A total of 15 watercourses were subject to a water vole presence/absence survey to confirm whether or not water voles are present. The remaining two watercourses which had been scoped into the 2018 Water Vole Survey could not be surveyed due to landowner access restrictions.
28. The 2018 Water Vole Survey was undertaken in accordance with the methodology set out in the Water Vole Conservation Handbook (3rd Ed.) (Strachan, Moorhouse and Gelling, 2011) and as modified by The Water Vole Mitigation Handbook (Dean *et al.*, 2016). Surveys were conducted along one bank for the full length of each optimal watercourse within the survey area (i.e. within the project area, plus 50m upstream and 50m downstream). Each watercourse was surveyed in 100m sections. Each 100m section was walked by an ecologist, and all field signs of water vole were recorded. This included sightings, burrows, latrines, feeding stations, lawns, nests, footprints and runways. The field sign type and its location were recorded. A photograph was taken for each field sign observed. In addition to all water vole field signs, field signs of other aquatic mammals (e.g. rats, otter and mink) were also recorded. The habitats adjacent to the survey area were recorded and mapped. Detailed information on bankside species and watercourse characteristics were recorded for each watercourse during the Extended Phase 1 Habitat Survey, and this information has been revised and updated during the Water Vole Survey where conditions have changed.
29. The survey involved one visit during the mid-April – June survey season, when water voles are breeding but vegetation is not too dense to observe field signs. A second visit was not considered to be required for any of the watercourses surveyed, as the assessment of the effects on water voles can be made on a precautionary basis for all watercourses assessed, and all surveys were conducted during the optimum period within the water survey season (mid-April – June), when vegetation was low but weather conditions had allowed for a consistent period of activity prior to surveys.
30. Weather conditions were also recorded during the survey.

3.3 Surveyors

31. The 2018 Water Vole Survey was conducted by a team of two Royal HaskoningDHV ecologists. The survey team was led by Charlotte Clements, BSc. Affiliate Member of the Institute of Environmental Assessment (IEMA). Charlotte has 3 years' experience of water vole surveying. The survey team included:

- Maria Walentek, BSc. MSc. Associate Member CIEEM (ACIEEM).

3.4 Weather Conditions

32. Table 3.1 summarises the weather conditions encountered during the survey period.

Table 3.1 Weather conditions

Date	Weather conditions
23 rd April 2018	Sunny spells and cloud (15°C)
24 th April 2018	Light rain showers (12°C)

3.5 Survey Limitations

33. Of the 17 watercourses scoped into the 2018 Water Vole Survey, it was not possible to access two watercourses (NB-WV13 and NB-WV-14) due to landowner access restrictions. These watercourses will be required to be surveyed at a subsequent date, as soon as access becomes available and in advance of any works at these locations.

34. In the case of WV11, access to the waterway was restricted due to overgrowth by hedges and brambles. For this watercourse, the survey was conducted from accessible areas only, and observations were made, where possible, from the bank. The details of the limitations experienced at each watercourse are recorded in full within Annex B: Full Survey Results. The limitations encountered were not considered to prevent reliable survey results being obtained from any of the watercourses surveyed.

35. Whilst the survey team made the utmost effort to pick up all field signs present during the field survey, on occasion due to human error some field signs can be missed or overlooked. However and despite this, the data presented in this report is considered to provide an accurate description of the habitats within the survey area and provide a robust understanding of the survey area's water vole population.

4 Results

36. This section presents the results from both the 2018 Water Vole Survey and provides a summary of the combined results from both the 2017 and 2018 Water Vole

Surveys. For full details of the 2017 Water Vole Survey, please refer to Appendix 22.6 2017 Water Vole Survey Report.

4.1 2018 Water Vole Survey

4.1.1 Field signs

37. Field signs of water vole were found in three of the 15 watercourses surveyed during the 2018 Water Vole Survey. Field signs found included latrines, burrows, pathways and feeding remains.
38. Two watercourses were found to be completely dry during the 2018 Water Vole Survey and were consequently reassessed as being unsuitable (sub-optimal) for supporting water voles. Consequently, no surveys were undertaken of these watercourses.
39. Table 4.1 summarises the findings of the 2018 Water Vole Survey which has been undertaken to date. The full results from the 2018 Water Vole Survey are contained Table 9.1 in Annex B: Full Water Vole Survey Results. The location of all the field signs recorded during the 2018 Water Vole Survey are shown on Figure 22.3.3, Annex A: Figures.

Table 4.1 Summary of the 2018 Water Vole Survey

Watercourse	Latrines	Burrows	Sightings	Footprints	Pathways	Feeding remains	Comments
NB-WV01	1	6				1	Plenty of food sources, ditch showing signs of erosion, Right Hand Bank (RHB) undercut.
NB-WV03	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.						
NB-WV04	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.						
NB-WV05							Optimal conditions for water voles, but no sign of presence.
NB-WV06							Suboptimal conditions with shallow ditch at time of survey and poor water quality with limited material for burrowing.
NB-WV07		1			1		Some pathways, no other signs. Ditch at edge of woodland, limited in-channel vegetation.
NB-WV08							Fast flowing river, banks suitable for burrowing, edge of woodland.

Watercourse	Latrines	Burrows	Sightings	Footprints	Pathways Feeding remains	Comments
NB-WV09						Shallow ditch at time of survey, dense in-channel vegetation.
NB-WV10		2			1	Two potential burrows and pathway. Very steep banks and poor water quality.
NB-WV11						Shallow ditch, low water level. No access in some places due to dense bramble.
NB-WV12						Shallow ditch dry in places. Dense vegetation, suboptimal for water voles.
NB-WV15						None
NB-WV16						Evidence of erosion of banks, steep bank and fast flowing river. Little in-channel vegetation.
NB-WV17						Dense in-channel vegetation, moderate water quality (connected to NB-WV18).
NB-WV18						Dense in-channel vegetation, moderate water quality (connected to NB-WV17).

4.1.2 Relative Population Size

40. The numbers of latrines found during each survey can be used to calculate an indication of population size (Dean *et al.*, 2016). Table 4.2 shows the values of latrine density which can be used to give an estimate of population size (note that these values are most useful when indicating where the key areas within a survey area are).

Table 4.2 Calculation of estimated population size based on latrine numbers (adapted from Dean et al., 2016)

Reference Number	Approximate number of latrines per 100m of bankside habitat	
	First half of survey season (mid-April to end of June)	Second half of survey season (July to September)
High	10 or more	20 or more
Medium	3-9	6-19
Low	≤2 (or none, but with other confirmatory field signs)	≤5 (or none, but with other confirmatory field signs)

41. Using the guideline estimations in Table 4.2 an estimation of the population density of each 100m section of each watercourse surveyed has been undertaken. The results are shown in Table 4.3 below. Only watercourses where presence was recorded have been included.

Table 4.3 Water vole population density 2018

Water-course	Maximum number of latrines with a 100m section	Other field signs	Highest population density recorded within watercourse
WV01	1	Yes	Low
WV07	0	Yes	Low
WV10	0	Yes	Low

42. From the three water courses where evidence of water voles had been recorded during 2018 returned a maximum estimated low water vole population density.

4.2 Combined survey results (2017 and 2018 Water Vole Surveys)

43. Field signs of water vole were found in seven of the 31¹ watercourses surveyed during the 2017 Water Vole Survey. Field signs found included latrines, burrows, pathways, footprints and feeding remains. These are summarised in Table 4.4. The full results are contained in Annex B: Full Water Vole Survey Results.
44. In addition, a water vole sighting was made on 16th May 2017 during one of the great crested newt surveys adjacent to watercourse WV13.
45. Therefore, in combination, field signs of water vole were found in 10 of 46 watercourses surveyed during 2017 and 2018.
46. In combination, a total of four watercourses were not surveyed in 2017 or 2018 due to landowner access restrictions.

Table 4.4 Combined results: Watercourses with water vole presence recorded in 2017 or 2018 Water Vole Surveys

Survey	Water-course	Latrines	Burrows	Sightings	Footprints	Pathways	Feeding remains	Other field signs	Comments
2017	WV01		1						None
2017	WV05		1						None

¹ Of the 33 watercourses scoped into the 2017 Water Vole Survey, two could not be surveyed due to access restrictions, therefore only the remaining 31 were surveyed during 2017.

Survey	Water-course	Latrines	Burrows	Sightings	Footprints	Pathways	Feeding remains	Other field signs	Comments
2017	WV13		2	1					No detailed survey undertaken due to dense vegetation cover. One sighting recorded in pond adjacent to watercourse during related survey on 16th May 2017. <u>Further surveys will be attempted in 2017.</u>
2017	WV14						1		None
2017	WV15	2	3			1	2	1 otter spraint	None
2017	WV32	15	5		1		14	2 rat feeding signs	None
2017	WV22		1			2		1 otter spraint	Cows present in field on opposite bank. Runs may have been caused by swans/geese observed in the area.
2018	NB-WV01	1	6				1		Plenty of food sources, ditch showing signs of erosion, RHB undercut.
2018	NB-WV07		1			1			Some pathways, no other signs. Ditch at edge of woodland, limited in-channel vegetation.
2018	NB-WV10		2			1			Two potential burrows and pathway. Very steep banks and poor water quality.

47. One of the seven watercourses where field signs of water voles were recorded (WV32) contained a high relative population density. The remaining six contained a low population density only. Within watercourse WV32, the population density varied between low and high throughout the area surveyed.

4.3 Habitats

48. The adjacent habitats found throughout the survey area during both the 2018 and 2017 Water Vole Surveys were typically agricultural in nature, with arable crops and cattle grazing being the most common adjacent land use types recorded. The

function of the watercourses surveyed also reflected the predominantly agricultural nature of the environment, as the majority were artificial field drainage ditches. Natural watercourses such as the River Wensum (at Dillington and at Swanton Morley) and the River Bure were also surveyed, as were other artificial watercourses (such as the Dilham Canal). Bankside habitat varied, with short grasses banks in areas of pastoral grazing, dense scrub and hedgerow covers at some drainage ditches and a mixture of marginal vegetation in other areas. A full summary of the habitat types found during the survey is contained within Table 9.1 and in Annex B: Full Water Vole Survey Results.

49. The habitats adjacent to each survey area recorded during the 2018 Water Vole Survey are shown on Figure 22.3.3, Annex A: Figures.

5 Conclusions

50. A Water Vole Survey of 15 watercourses located within 50m of the project onshore infrastructure to which survey access has been granted was undertaken during April 2018.
51. Evidence of water vole presence was found in three watercourses within the survey area. All contained a low relative population density.
52. Three watercourses were identified within the 2018 survey area where the presence of water voles has been confirmed; the population density in each of these watercourses is considered low.
53. During the 2017 Water Vole Survey, seven watercourses confirmed the presence of water voles, of which one (WV32) contained areas where relative water vole population density is considered to be high.
54. The combined result of the 2017 Water Vole Survey and the 2018 Water Vole Survey shows a total of 10 watercourses to have confirmed water vole presence. All watercourses contained a low relative population density, apart from WV32 (surveyed in 2017), which showed high relative population density.

6 Recommendations

6.1 Potential Impacts

55. Given the population of water voles recorded during the 2018 Water Vole Survey, consideration of the potential impacts of the project upon water voles will be required in order to ensure that adequate steps are taken to minimise the risk of killing or injuring any water vole or damaging any water vole burrows during construction. Specifically, the following potential impacts should be considered in detail:

- Habitat loss and deterioration;
 - Habitat fragmentation;
 - Incidental mortality during site clearance and construction;
 - Damage to burrows;
 - Introduction of domestic predators;
 - Change in management regime;
 - Pollution; and
 - Change in water level.
56. If any impacts are identified, the options for mitigating these at the design stage will be considered. Options for avoiding the areas of water vole presence will be considered first, followed by on-site mitigation, and finally offsite mitigation.
57. If mitigation is required in order to ensure there is no adverse impact on the water vole population identified due to the project, the Water Vole Mitigation Handbook (Dean *et al.*, 2016) should be used to inform any mitigation design and any licensing requirements for the project.

6.2 Further Surveys

58. For those watercourses surveyed as part of the 2018 Water Vole Survey, no further surveys are recommended at this stage (see section 3.2). Depending on the works planned within the survey area, pre-construction surveys (within the optimal survey season prior to construction) may be required and if this is the case an ecologist will need to be consulted.
59. The four watercourses scoped into the 2017 and 2018 Water Voles Surveys which could not be surveyed due to landowner access restrictions will require surveys post-consent. All watercourses² located within the survey area to which access permission has not yet been granted will also require a Water Vole Survey post-consent.

² The exact number of watercourses in the survey area for which permission for access has not yet been granted is currently not known and will not be known until the completion of an Extended Phase 1 Habitat Survey of these unsurveyed areas

7 References

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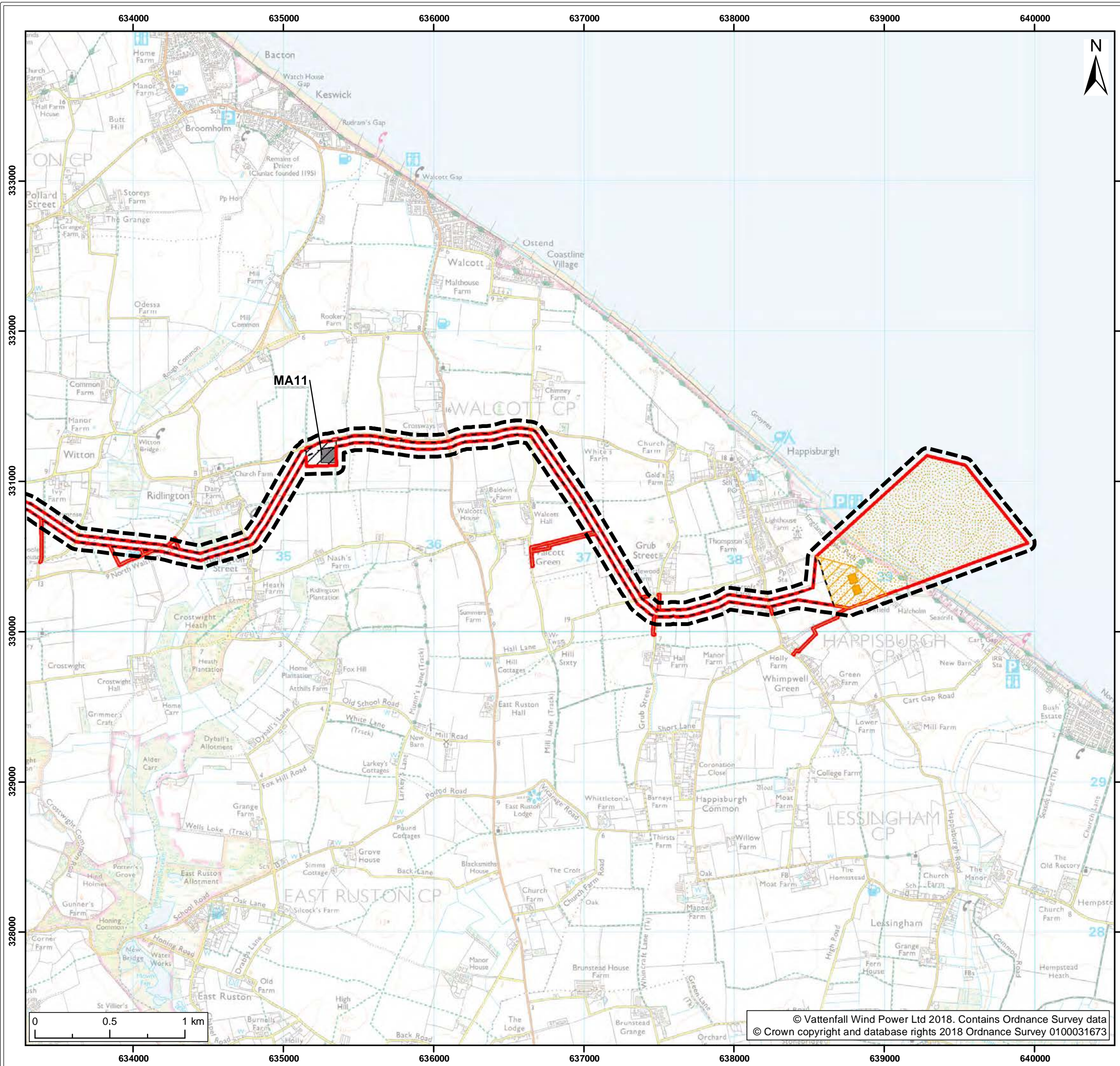
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8 Annex A: Figures



Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area

Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)

- Landfall zone
- Landfall compound zone
- Indicative landfall compound
- Onshore cable route
- Construction access
- Operational access

Norfolk Boreas Onshore Project Infrastructure (Scenario 2)

- Mobilisation zone
- Indicative mobilisation area compound

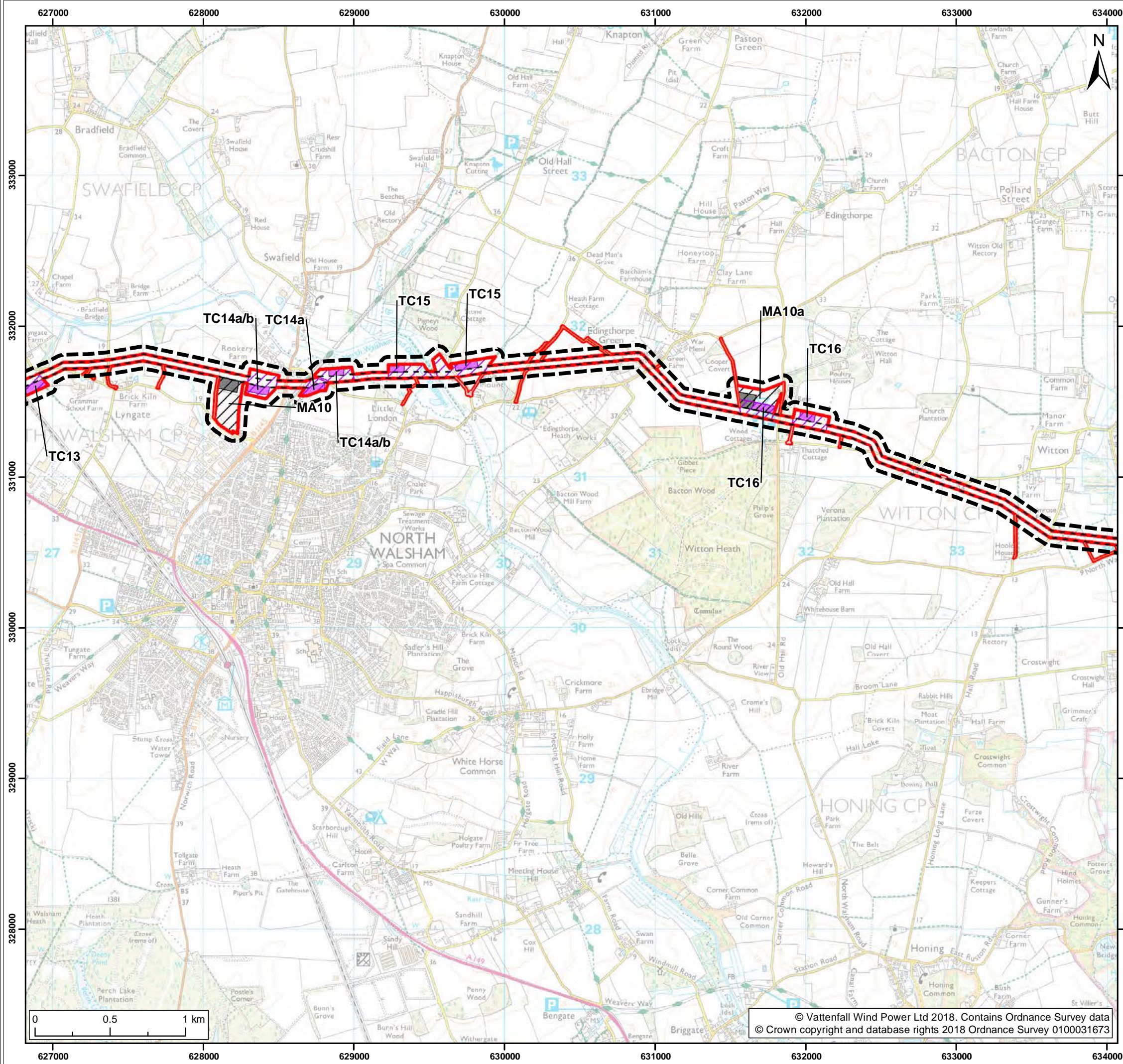
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Norfolk Boreas	Water Vole Survey report

Title:
Survey location (Map 1 of 9)

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01	19/07/2018	JH	GC	A3	1:25,000

Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area

Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)

- Onshore cable route
- Construction access
- Operational access

Norfolk Boreas Onshore Project Infrastructure (Scenario 2)

- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project:	Report:
Norfolk Boreas	Water Vole Survey report

Title:
 Survey location
 (Map 2 of 9)

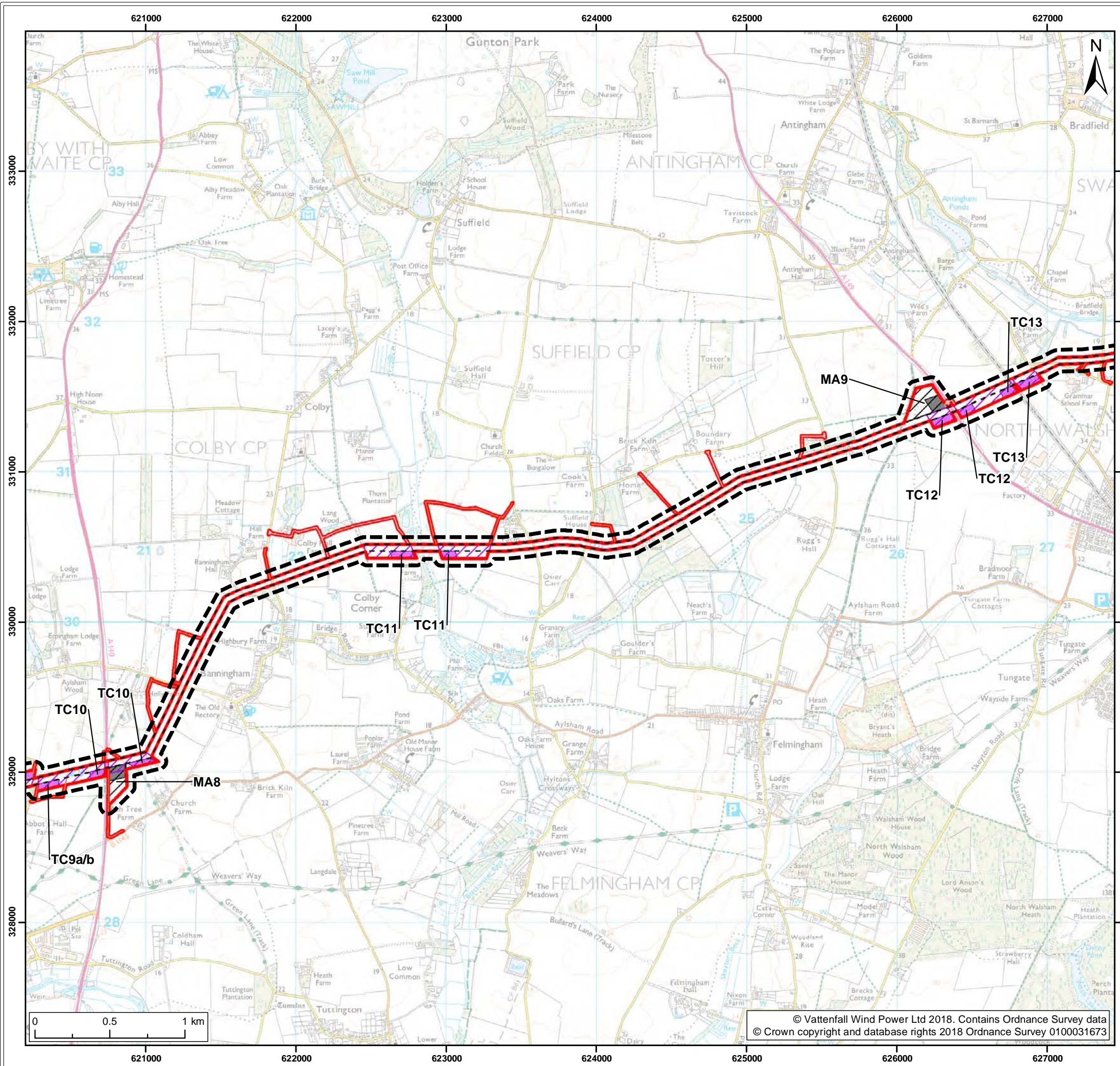
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area

Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)

- Onshore cable route
- Construction access
- Operational access

Norfolk Boreas Onshore Project Infrastructure (Scenario 2)

- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Survey location (Map 3 of 9)

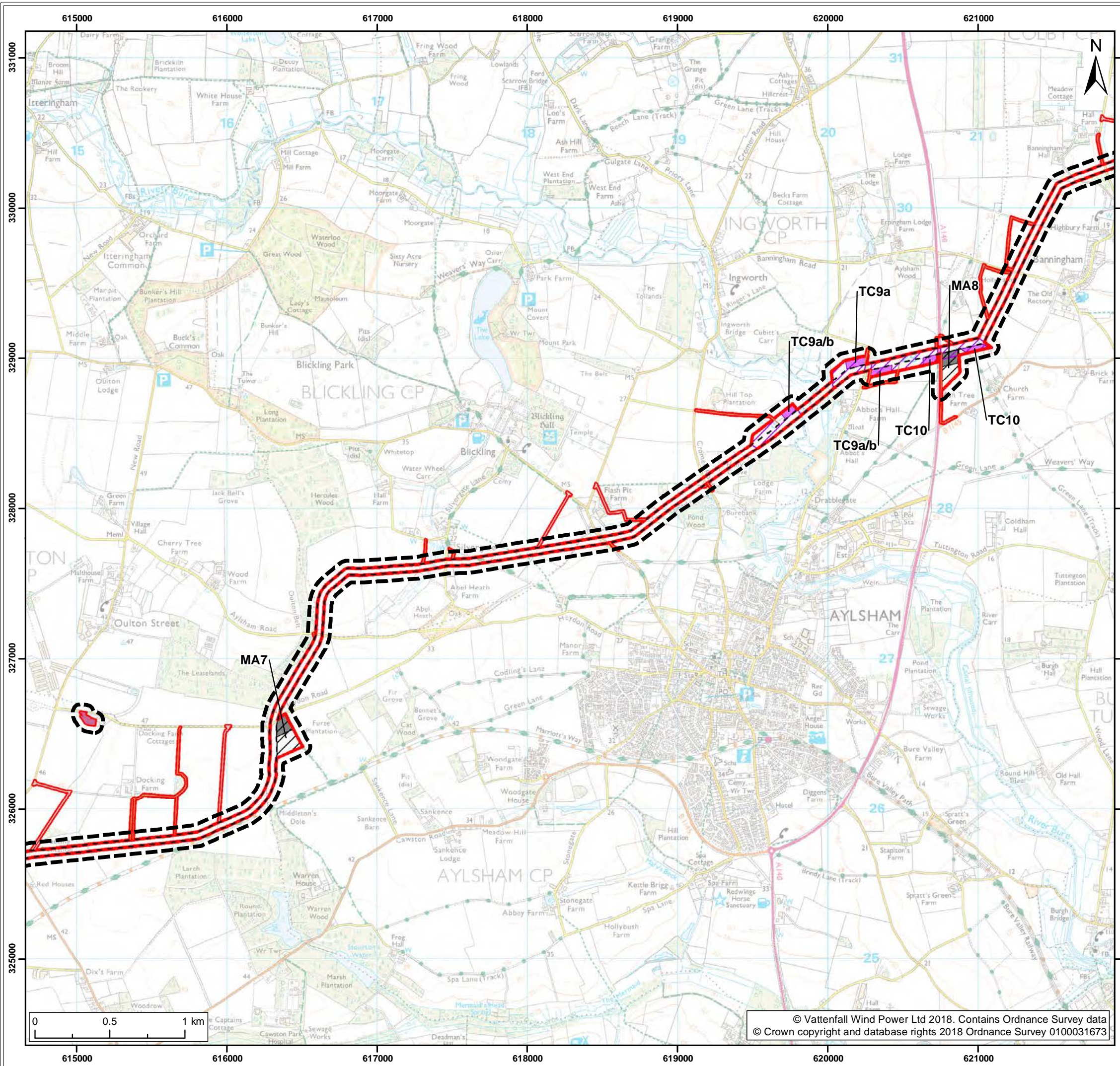
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area

Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)

- Onshore cable route
- Cable logistics area
- Construction access
- Operational access

Norfolk Boreas Onshore Project Infrastructure (Scenario 2)

- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Survey location (Map 4 of 9)

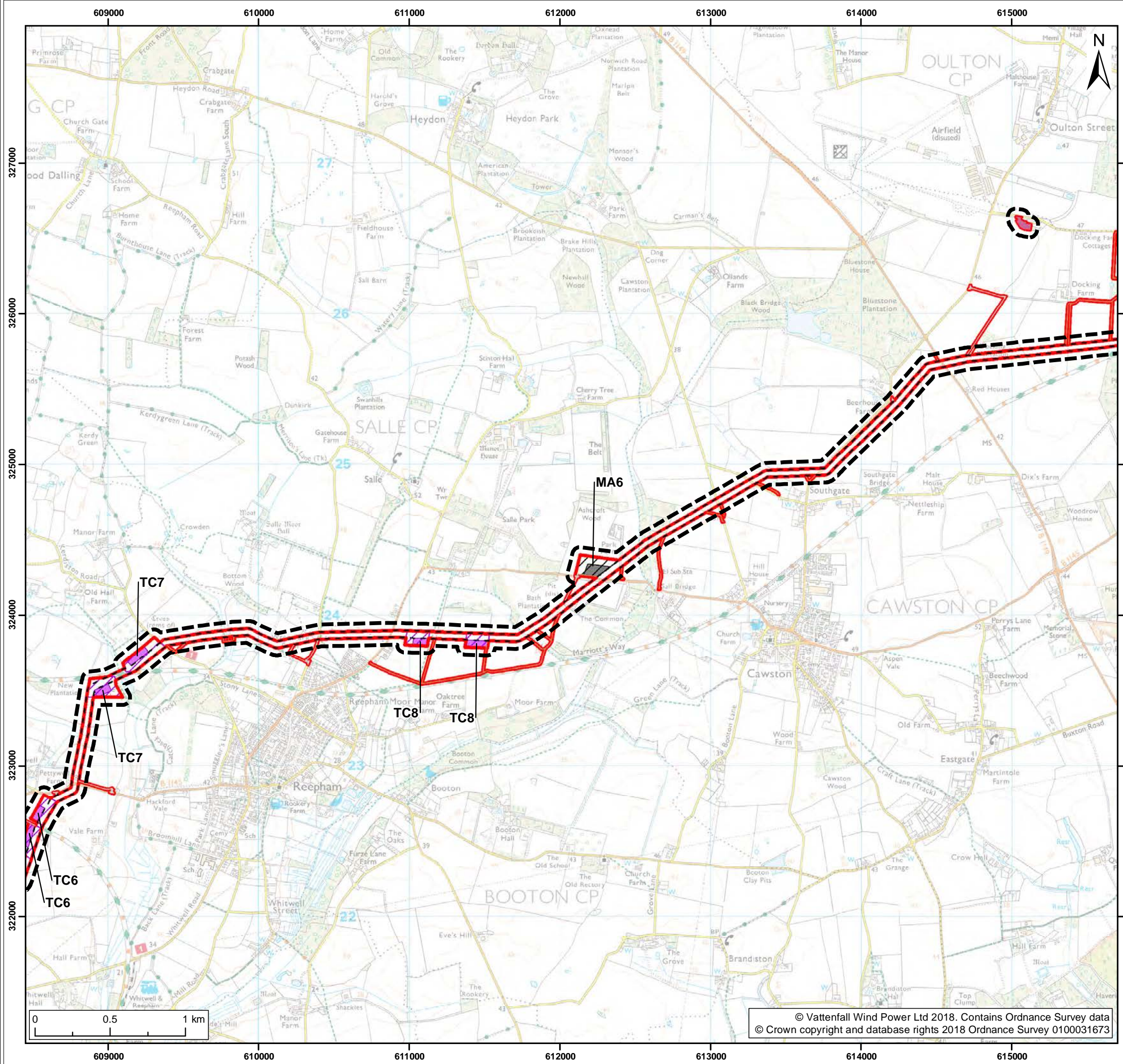
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area

Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)

- Onshore cable route
- Cable logistics area
- Construction access
- Operational access

Norfolk Boreas Onshore Project Infrastructure (Scenario 2)

- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Water Vole Survey report
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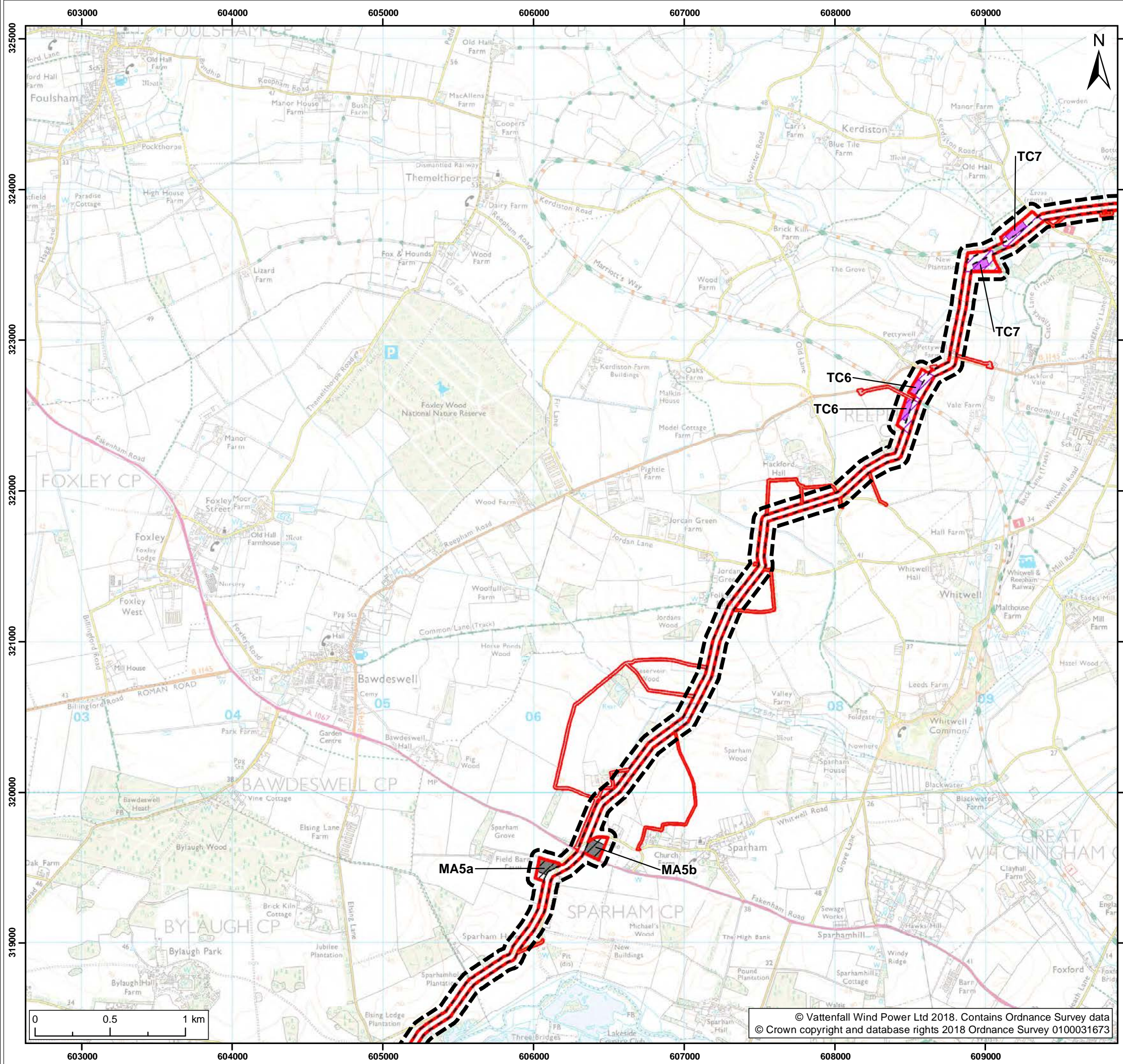
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Survey location (Map 5 of 9)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project:	Report:
Norfolk Boreas	Water Vole Survey report

Title:

Survey location
(Map 6 of 9)

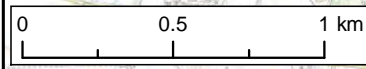
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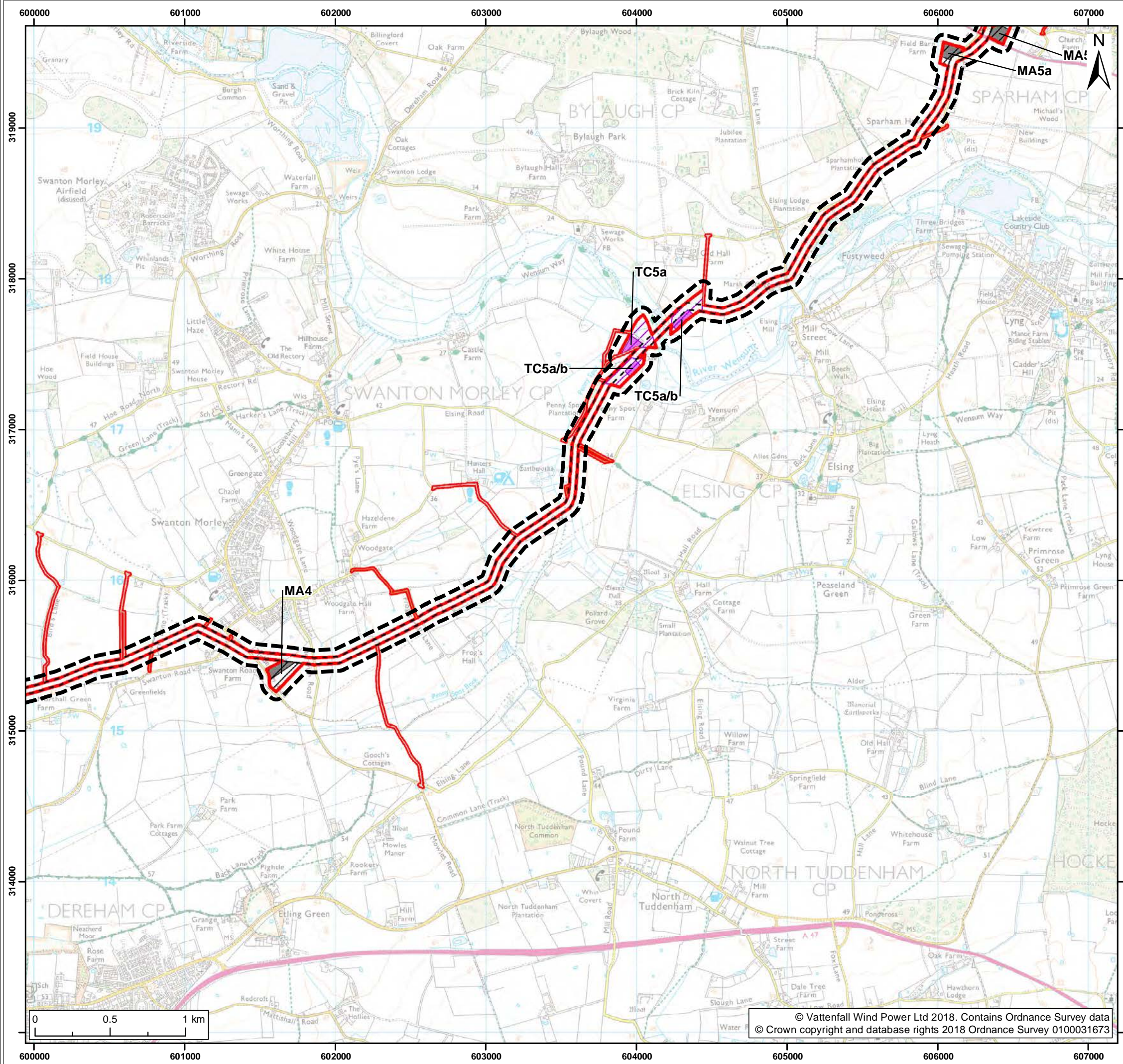
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Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area

Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)

- Onshore cable route
- Construction access
- Operational access

Norfolk Boreas Onshore Project Infrastructure (Scenario 2)

- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project:	Report:
Norfolk Boreas	Water Vole Survey report

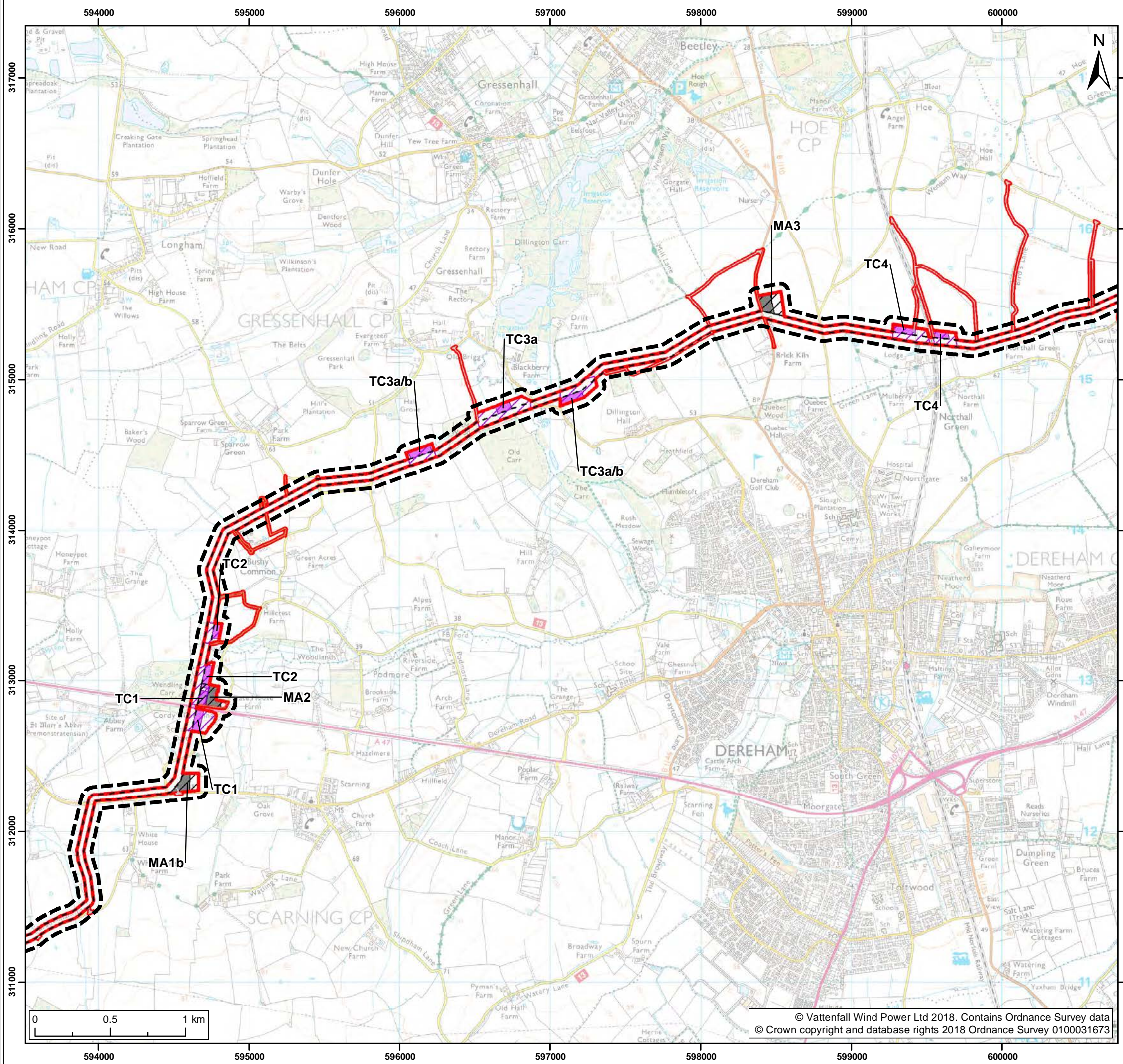
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Survey location
(Map 7 of 9)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Construction access
 - Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Trenchless crossing zone (e.g. HDD)
 - Indicative trenchless crossing compound
 - Mobilisation zone
 - Indicative mobilisation area compound

Project:	Report:
Norfolk Boreas	Water Vole Survey report

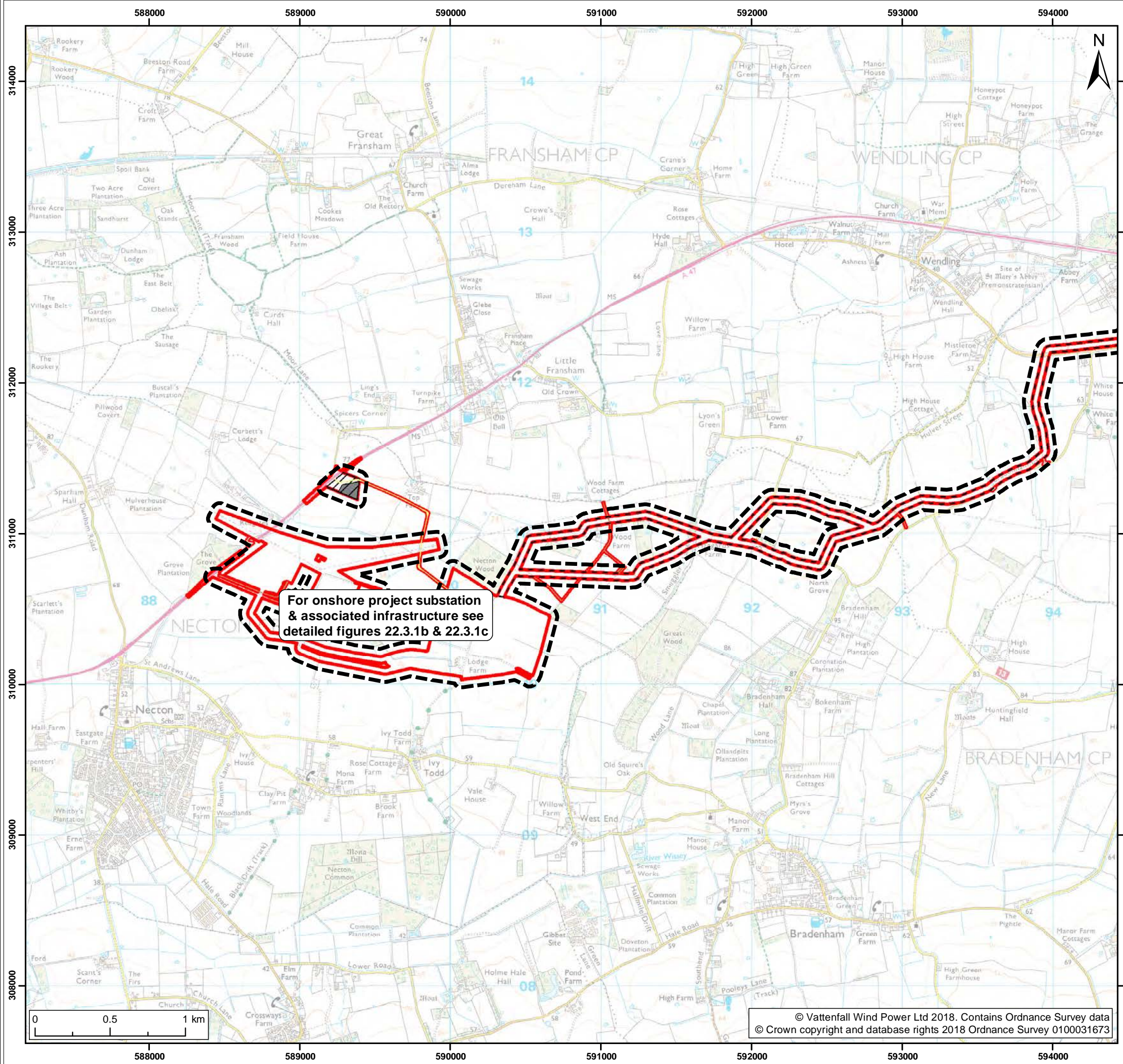
Title:
Survey location
(Map 8 of 9)

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Co-ordinate system: British National Grid EPSG: 27700

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For onshore project substation & associated infrastructure see detailed figures 22.3.1b & 22.3.1c

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- Legend:
- Norfolk Boreas red line boundary
 - Habitats and species study area
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
 - Mobilisation zone
 - Indicative mobilisation area compound
 - Construction access
 - Operational access
 - Permanent access

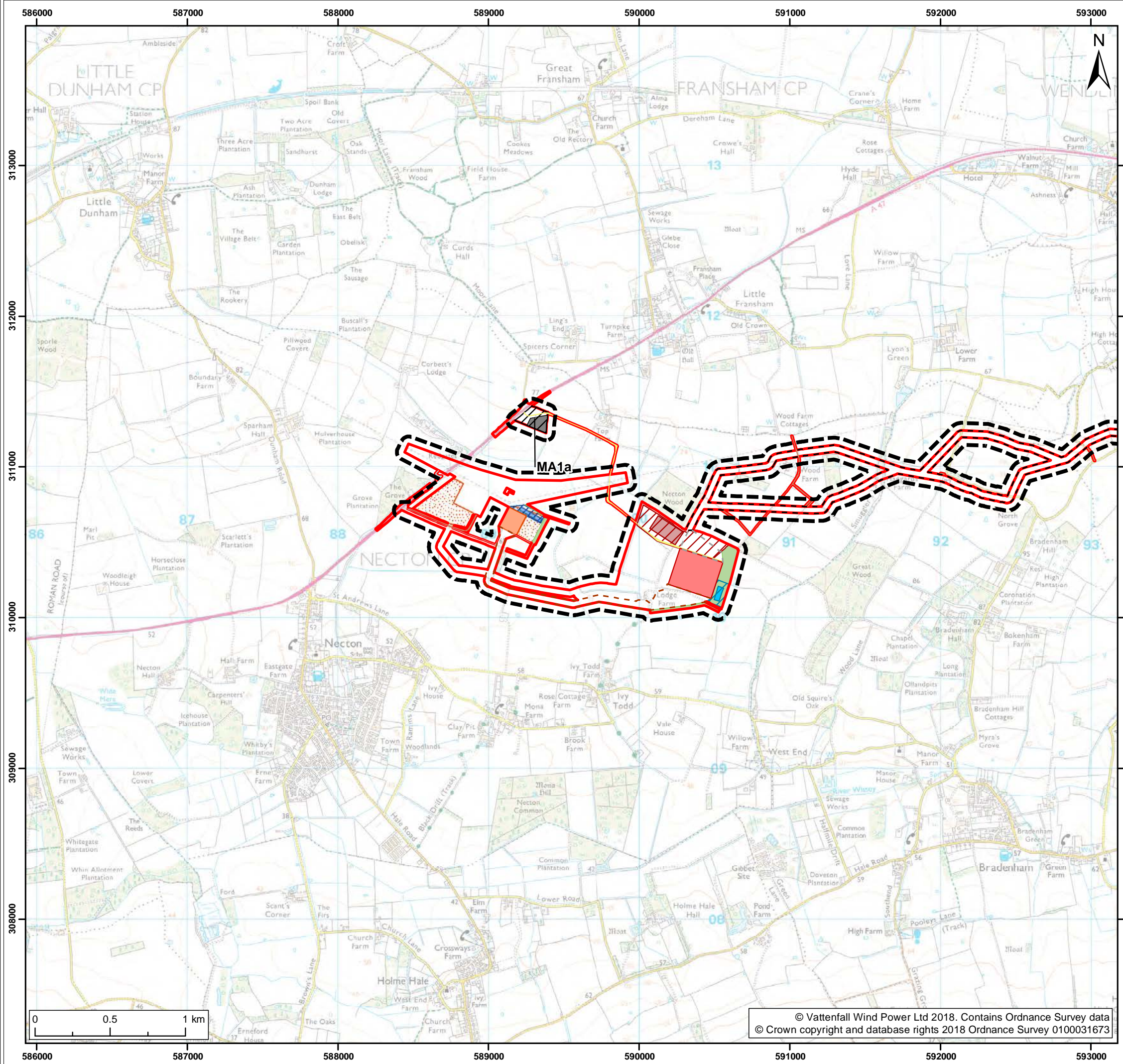
Project:	Report:
Norfolk Boreas	Water Vole Survey report

Title:
Survey location
(Map 9 of 9)

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Co-ordinate system: British National Grid EPSG: 27700





Legend:

- Norfolk Boreas red line boundary
- Habitats and species study area
- Onshore cable route
- Cable route entry to substation
- Onshore 400kv cable route
- Mobilisation zone
- Indicative mobilisation area compound
- Construction access
- Operational access
- Permanent access
- Onshore project substation
- Onshore project substation temporary construction compound zone
- Indicative onshore project substation temporary construction compound
- Attenuation pond zone
- Indicative attenuation pond
- Indicative mitigation planting
- National Grid substation extension
- National Grid temporary works
- National Grid attenuation pond location search area
- Indicative National Grid attenuation pond

Project:	Report:
Norfolk Boreas	Water Vole Survey report

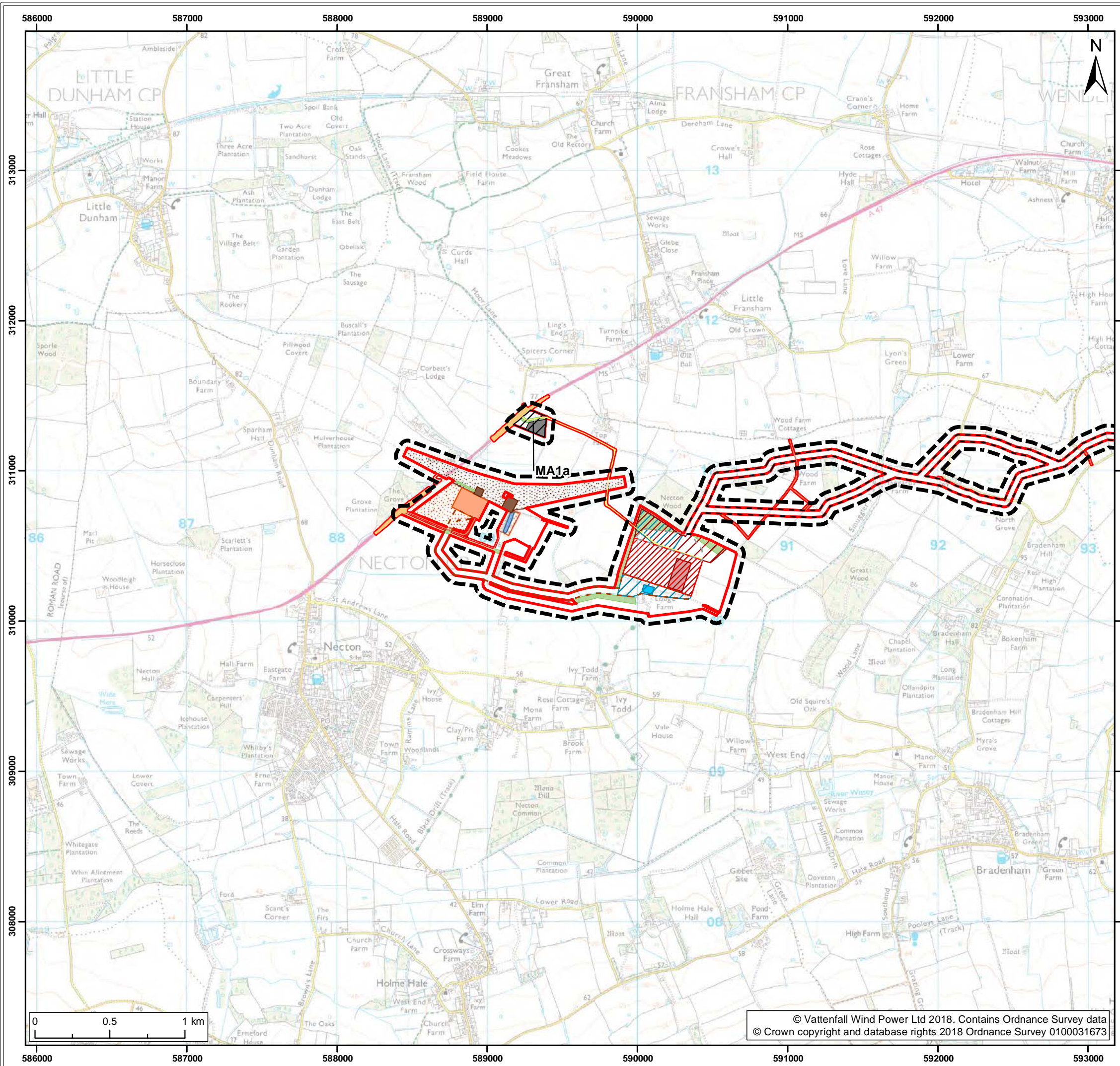
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Co-ordinate system: British National Grid EPSG: 27700



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- Legend:**
- Norfolk Boreas red line boundary
 - Habitats and species study area
 - Onshore cable route
 - Cable route entry to substation
 - Onshore 400kv cable route
 - Mobilisation zone
 - Indicative mobilisation area compound
 - Highways temporary works area
 - Construction access
 - Operational access
 - Permanent access
 - Onshore project substation search area
 - Onshore project substation temporary construction compound zone
 - Indicative onshore project substation temporary construction compound
 - Attenuation pond zone
 - Indicative attenuation pond
 - Indicative mitigation planting
 - National Grid substation extension
 - National Grid new / replacement OHL tower
 - National Grid temporary works
 - Overhead line temporary works
 - National Grid attenuation pond

Project: Norfolk Boreas	Report: Water Vole Survey report
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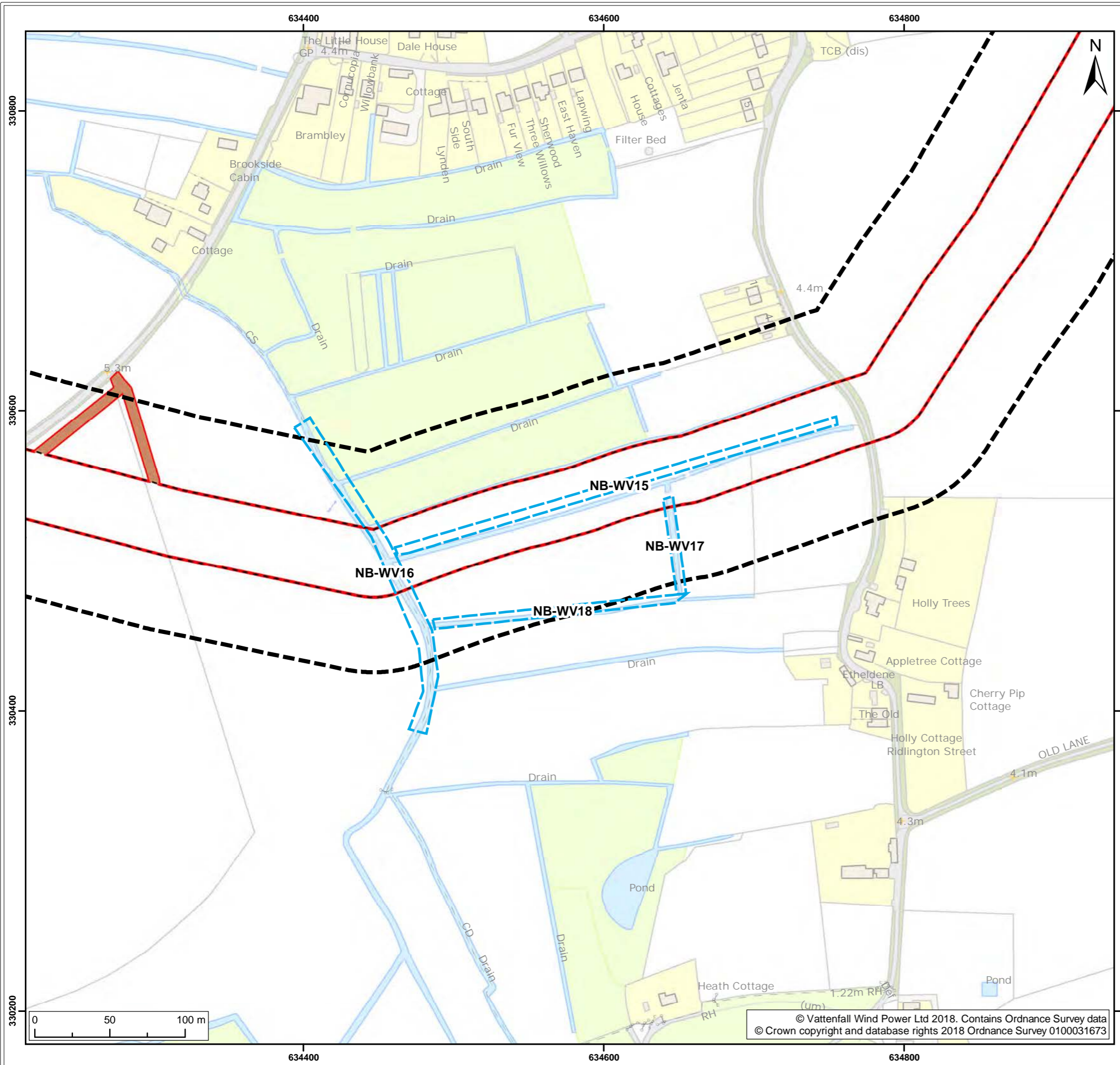
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Co-ordinate system: British National Grid **EPSG: 27700**



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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)

Project: Norfolk Boreas	Report: Water Vole Survey report
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Title:
Water bodies screened into further survey
(Map 1 of 10)

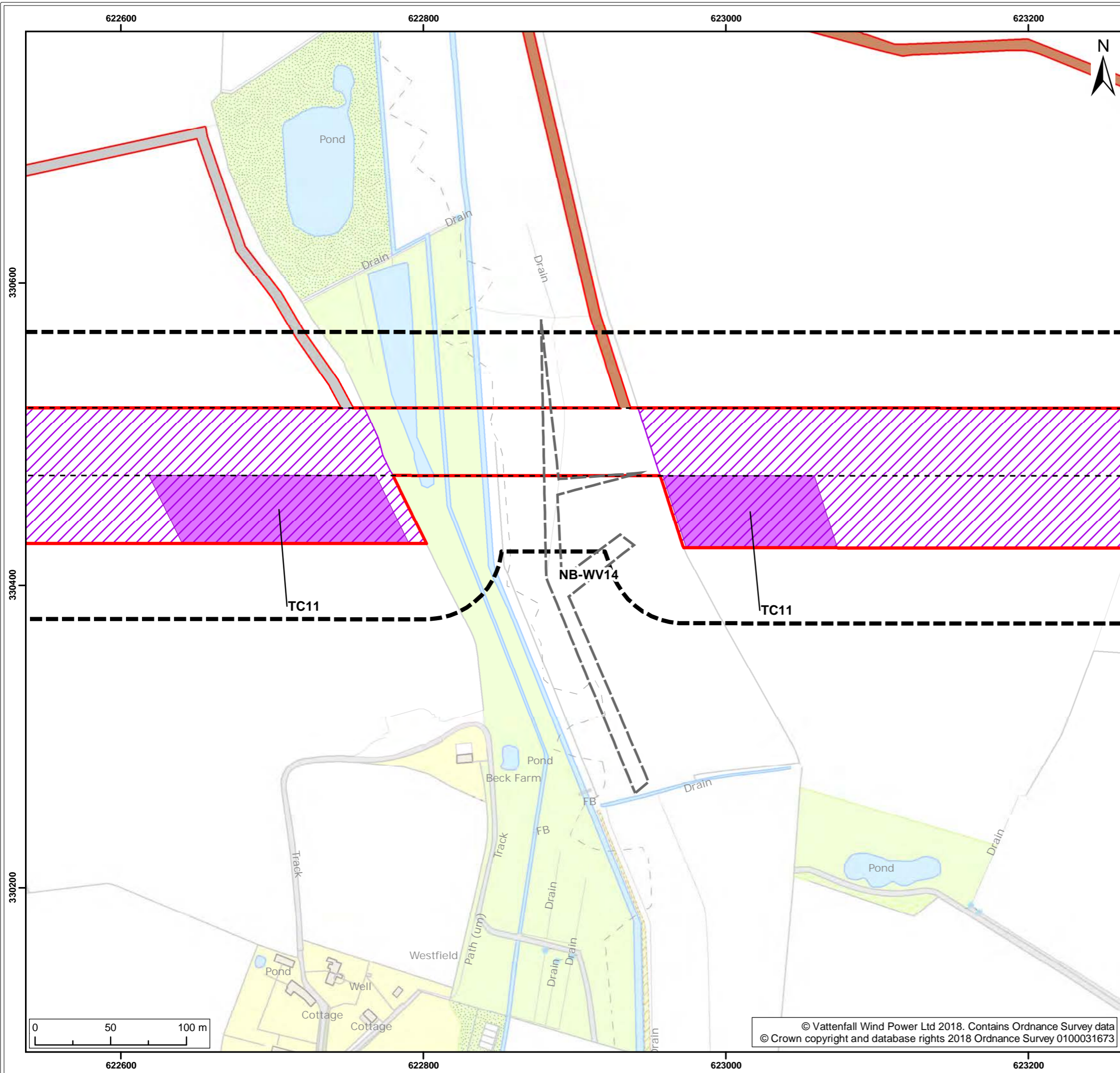
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Co-ordinate system: British National Grid **EPSG: 27700**

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Legend:

- Norfolk Boreas red line boundary

Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)

- Onshore cable route
- Construction access
- Operational access

Norfolk Boreas Onshore Project Infrastructure (Scenario 2)

- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound

Survey areas

- Habitats and species study area
- Water Vole survey extent (2018 survey area) (no access)

Project:	Report:
Norfolk Boreas	Water Vole Survey report

Title:
Water bodies screened into further survey
(Map 2 of 10)

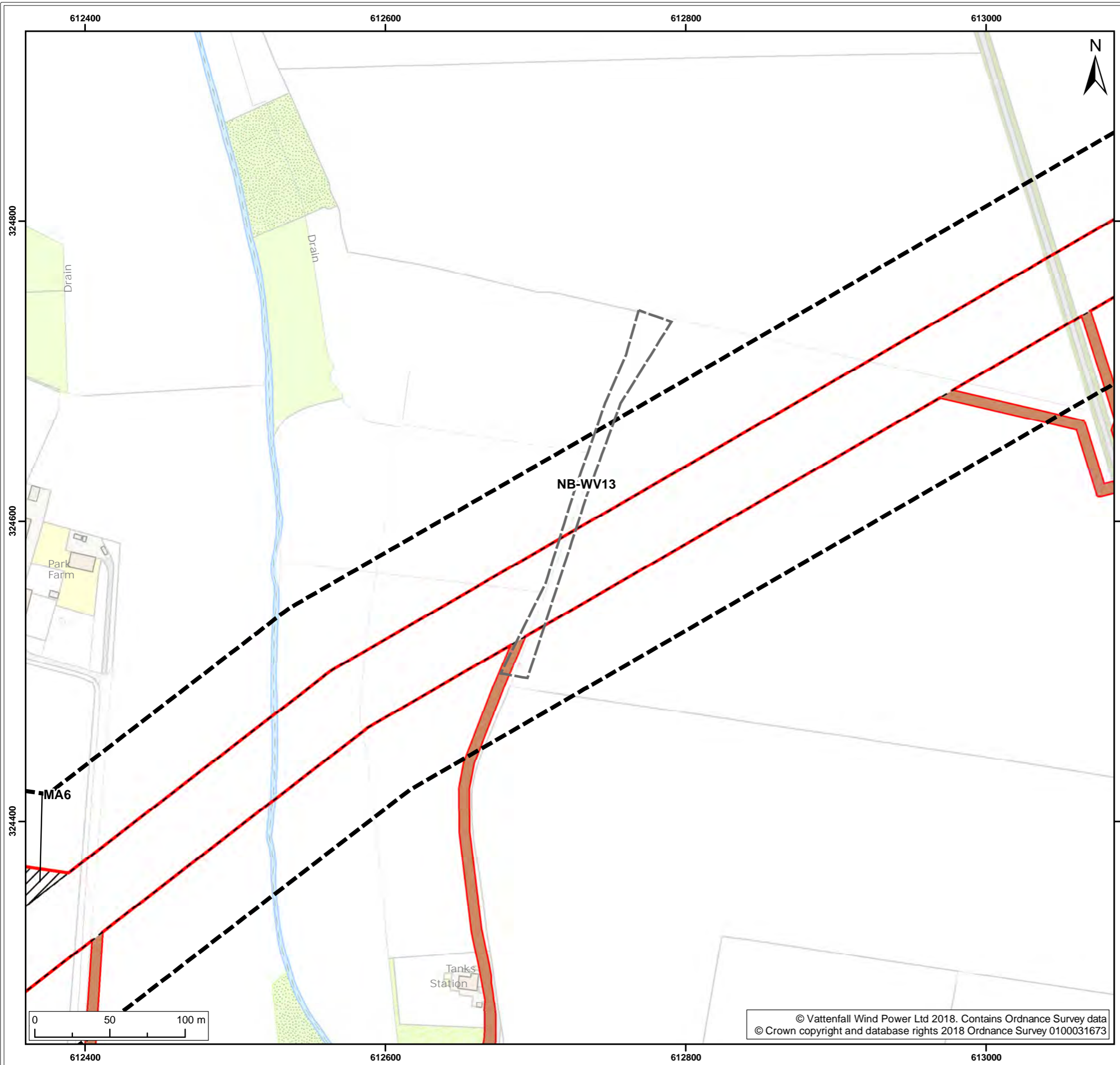
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Mobilisation zone
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area) (no access)

Project: Norfolk Boreas	Report: Water Vole Survey report
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Title:
Water bodies screened into further survey
(Map 3 of 10)

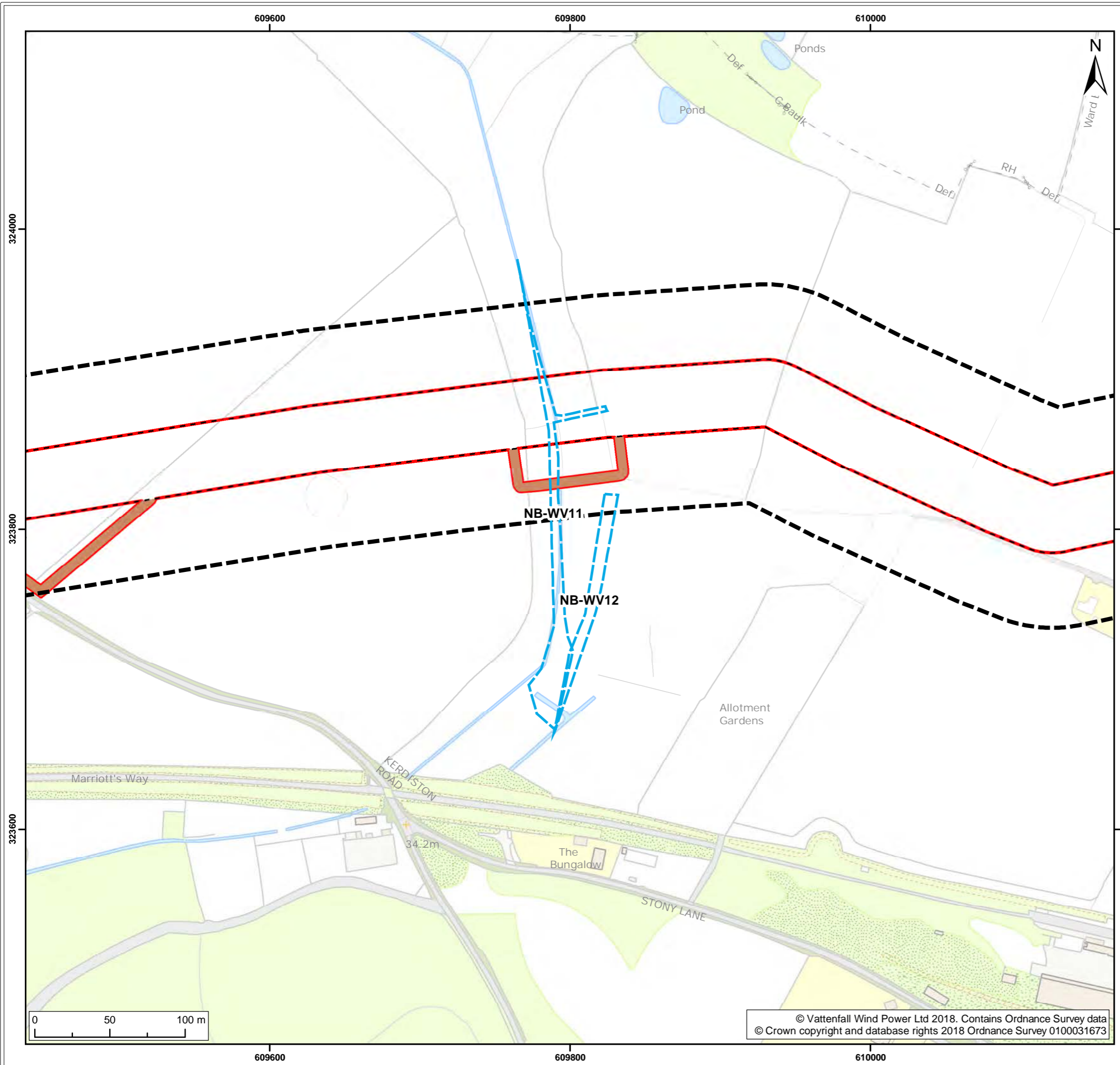
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water bodies screened into further survey
(Map 4 of 10)

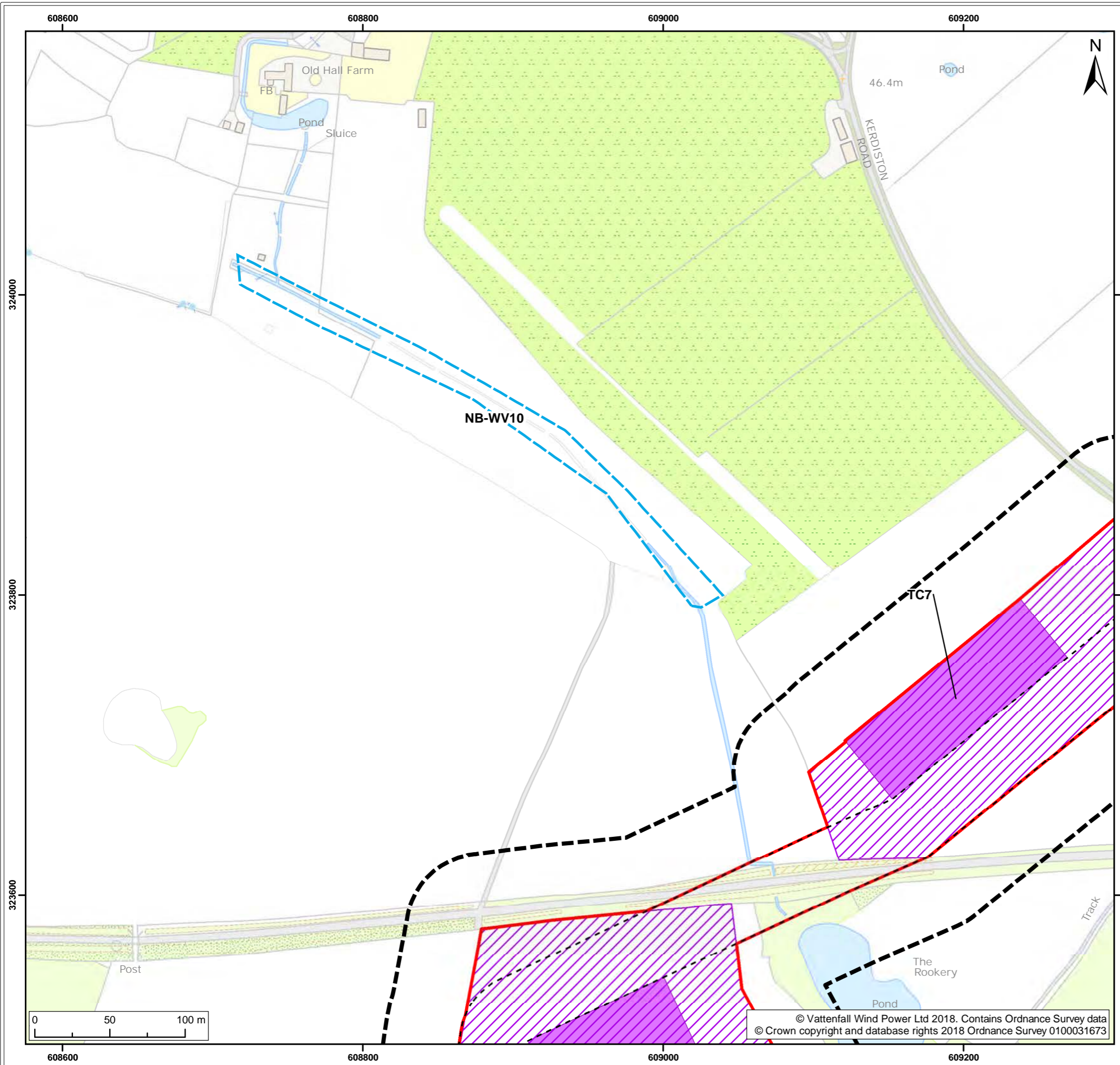
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)

Project:	Report:
Norfolk Boreas	Water Vole Survey report

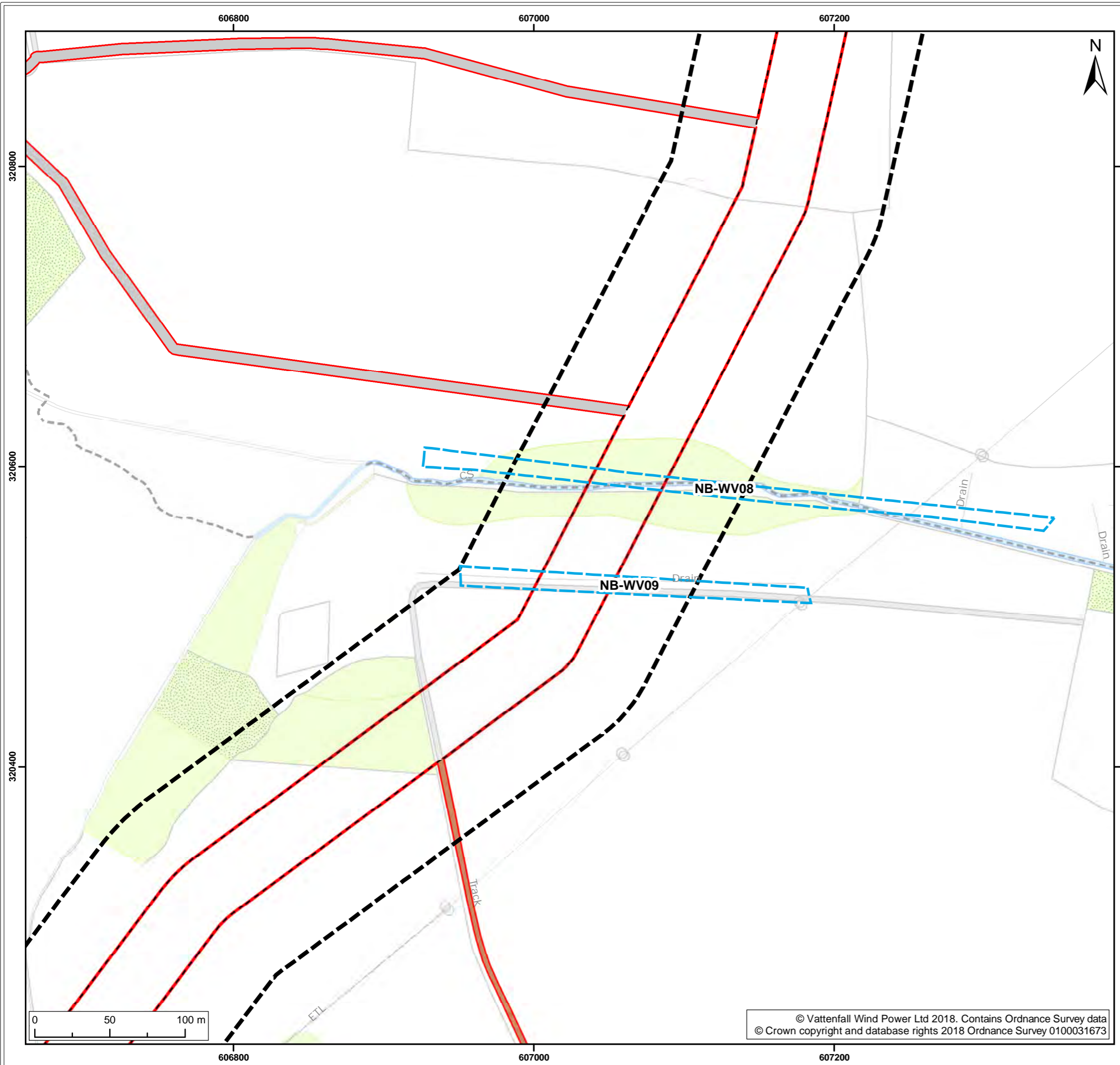
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Water bodies screened into further survey (Map 5 of 10)

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Co-ordinate system: British National Grid EPSG: 27700

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- Legend:
- Norfolk Boreas red line boundary
 - Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Construction access
 - Operational access
 - Survey areas**
 - Habitats and species study area
 - Water Vole survey extent (2018 survey area)

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

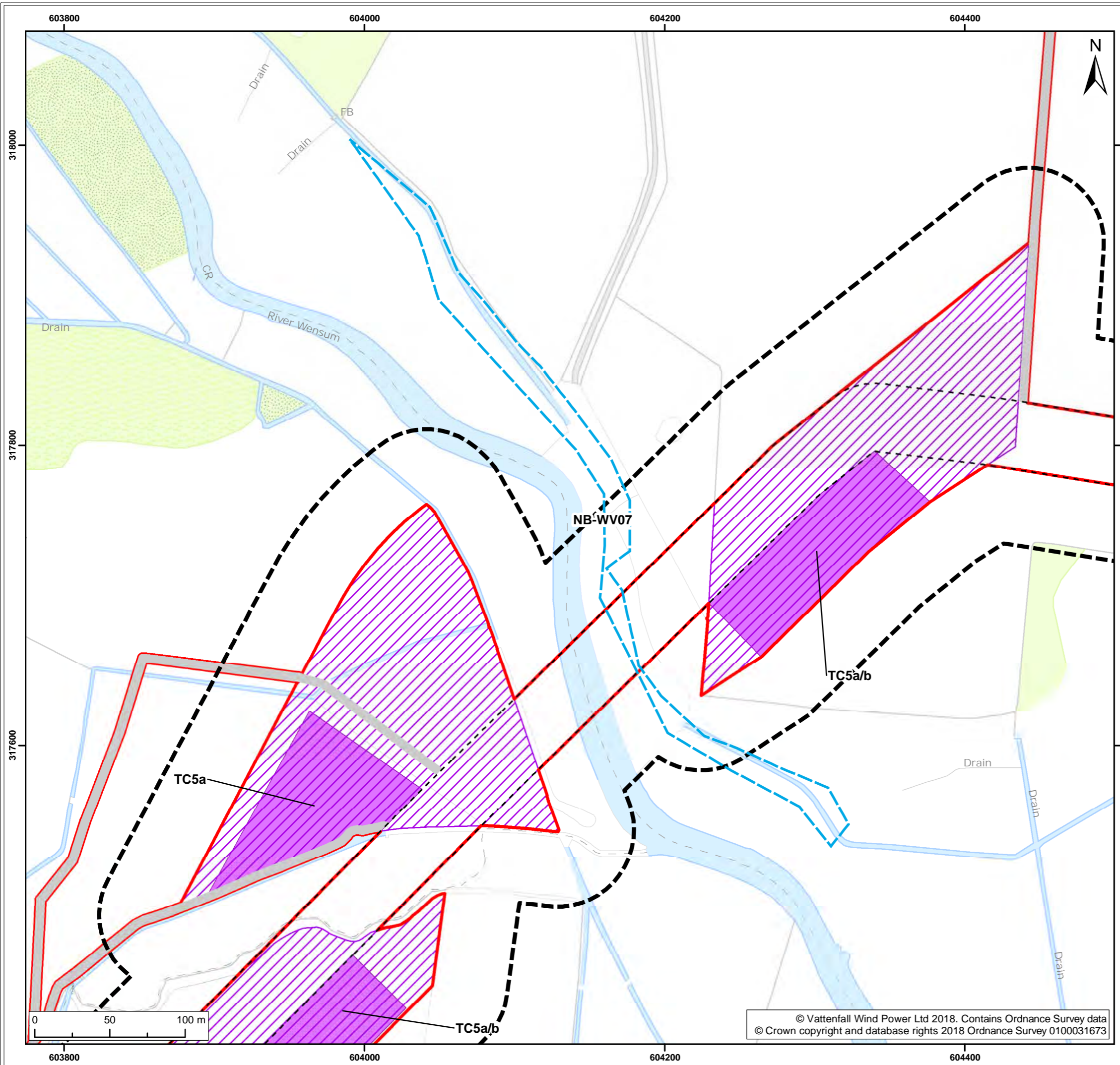
Title:
Water bodies screened into further survey
(Map 6 of 10)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water bodies screened into further survey
(Map 7 of 10)

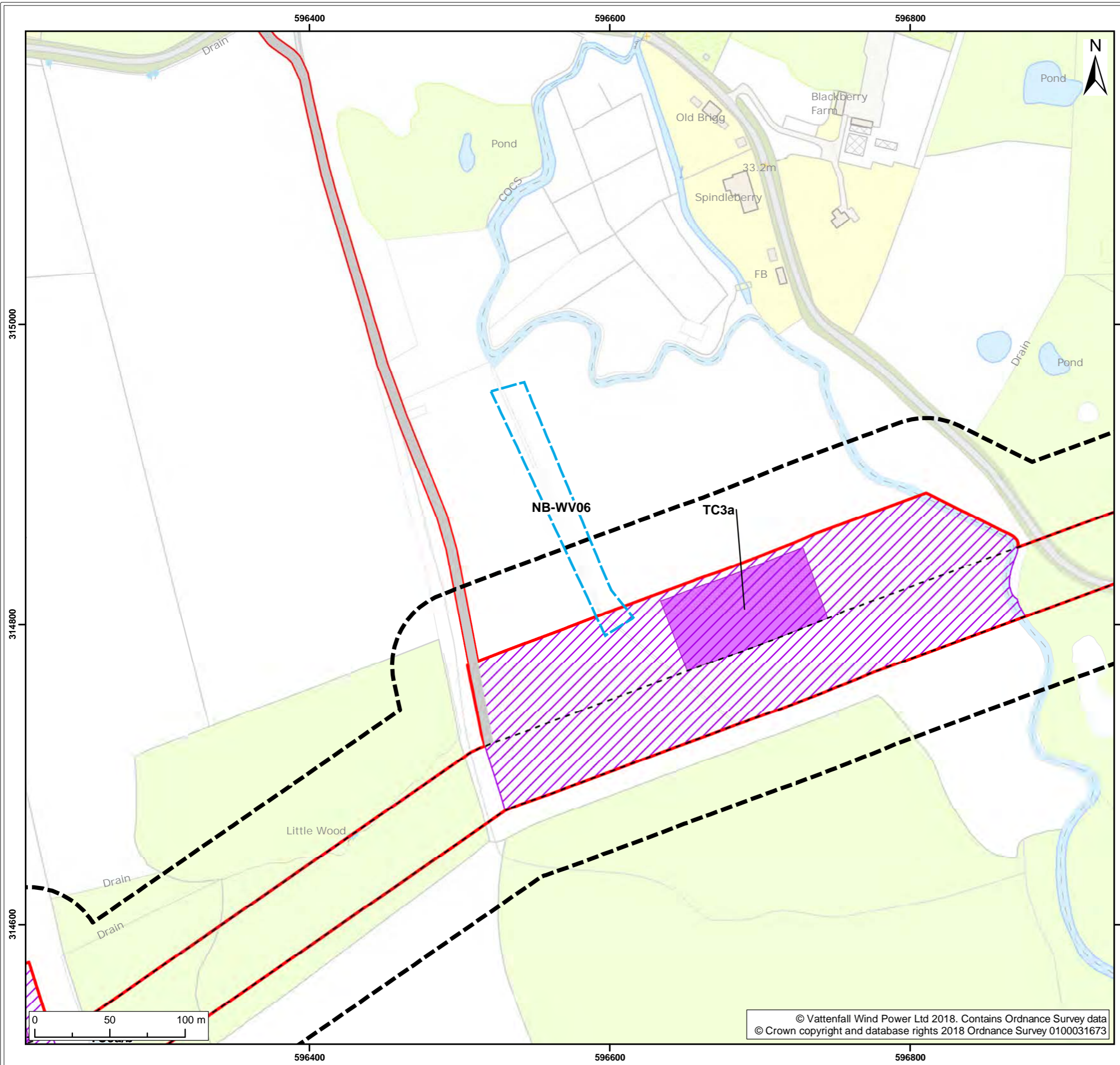
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)

Project: Norfolk Boreas	Report: Water Vole Survey report
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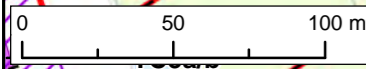
Title:
Water bodies screened into further survey
(Map 8 of 10)

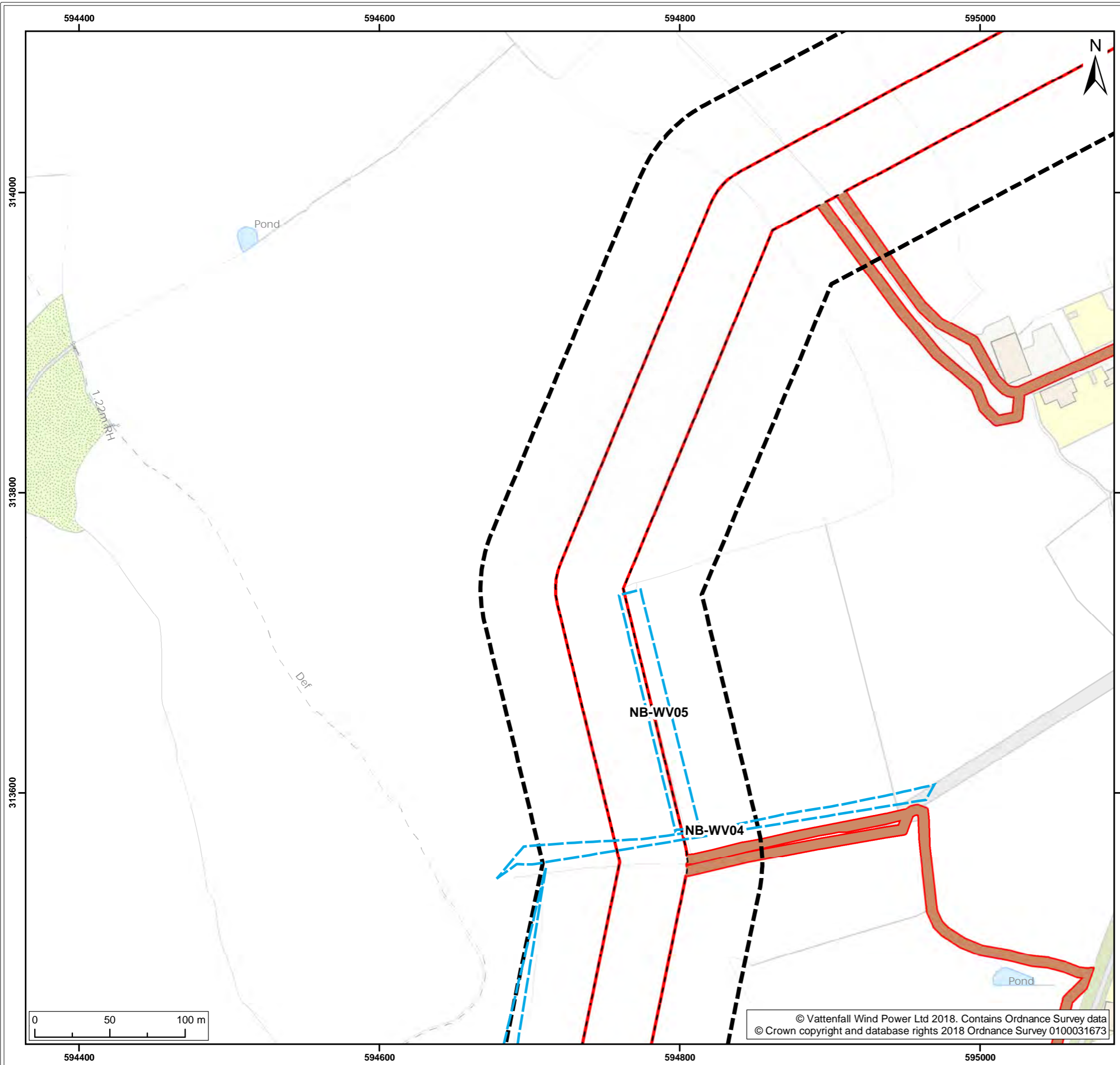
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02	14/08/2018	JT	GC	A3	1:2,500

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water bodies screened into further survey
(Map 9 of 10)

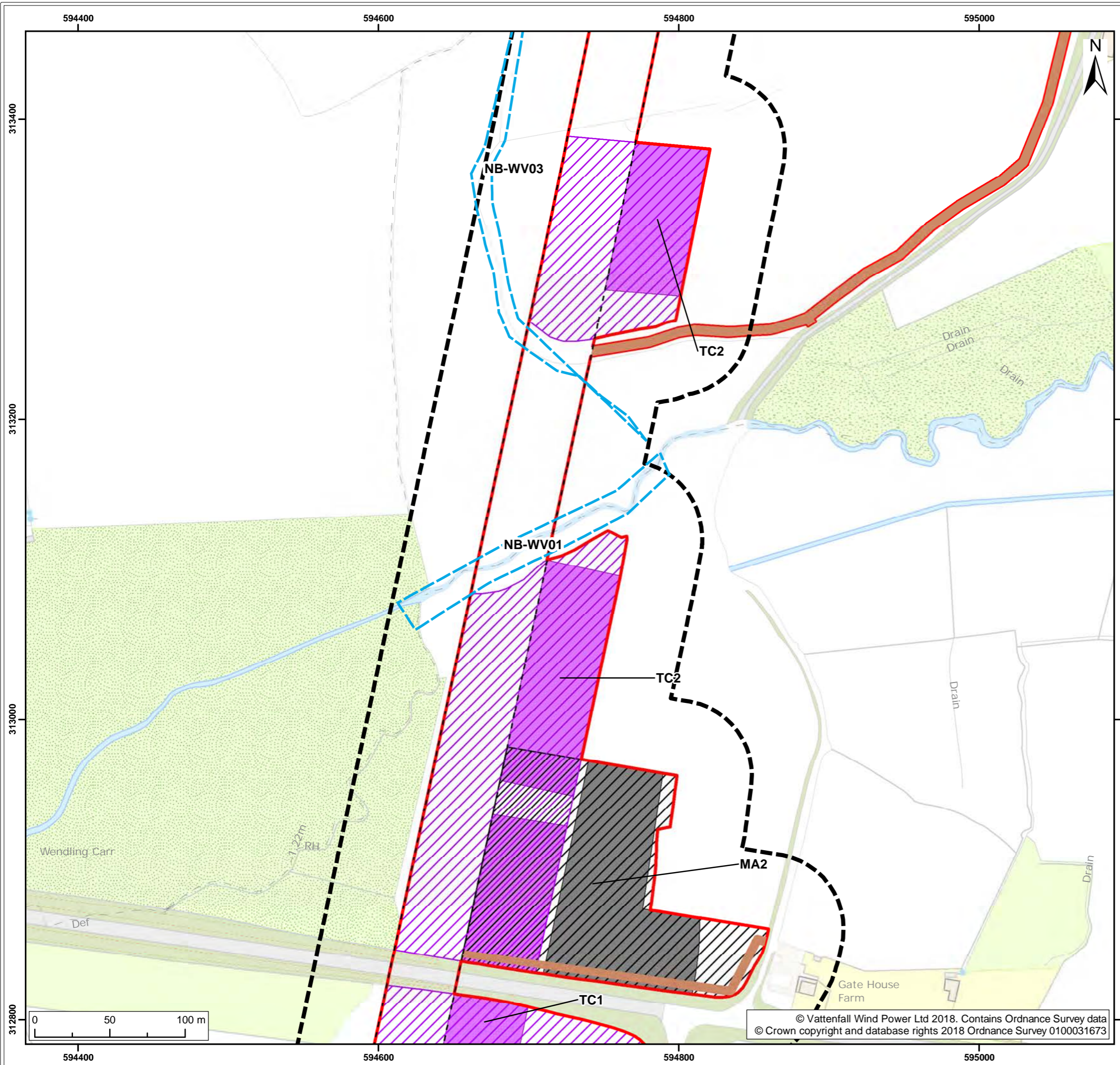
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

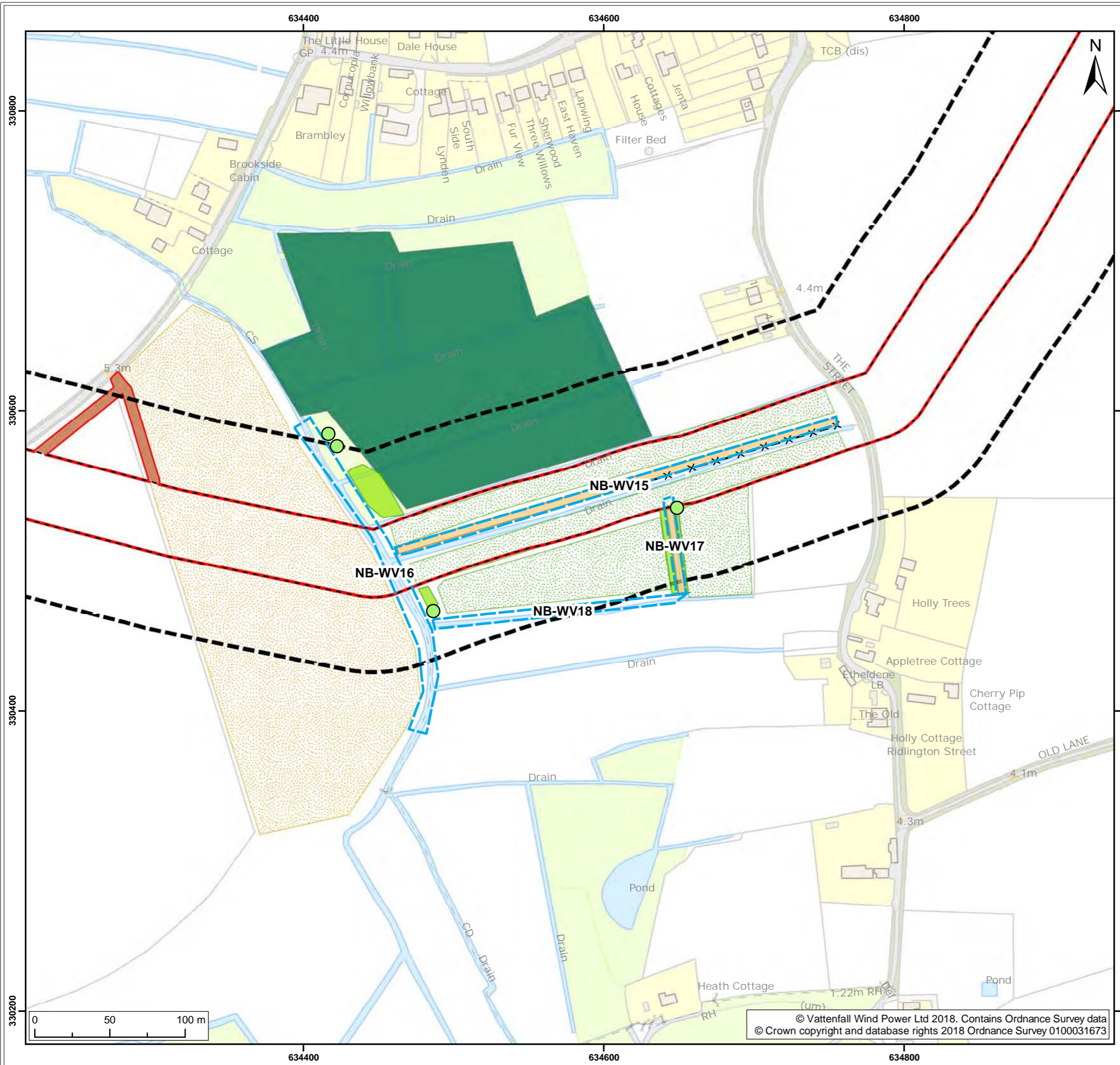
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Water bodies screened into further survey (Map 10 of 10)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)
- Bankside feature**
- × — × Fence
- Bankside vegetation**
- Saplings
- Scrub area
- Reedbeds
- Adjacent land use**
- Broadleaved woodland
- Rough Pasture
- Tilled land crop

Project: Norfolk Boreas	Report: Water Vole Survey report
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Title:
Water Vole Survey results
(Map 1 of 10)

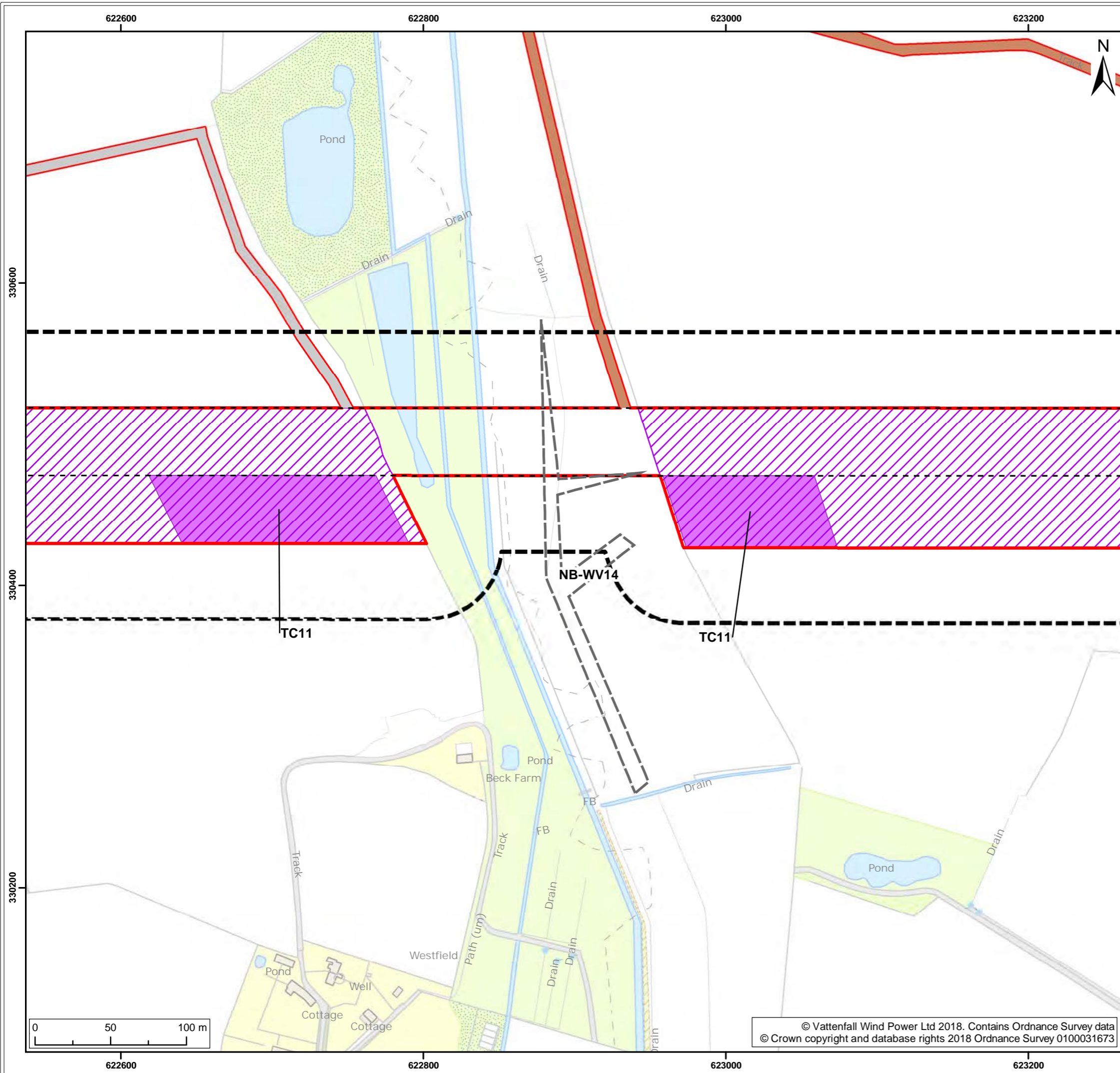
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area) (no access)

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water Vole Survey results
(Map 2 of 10)

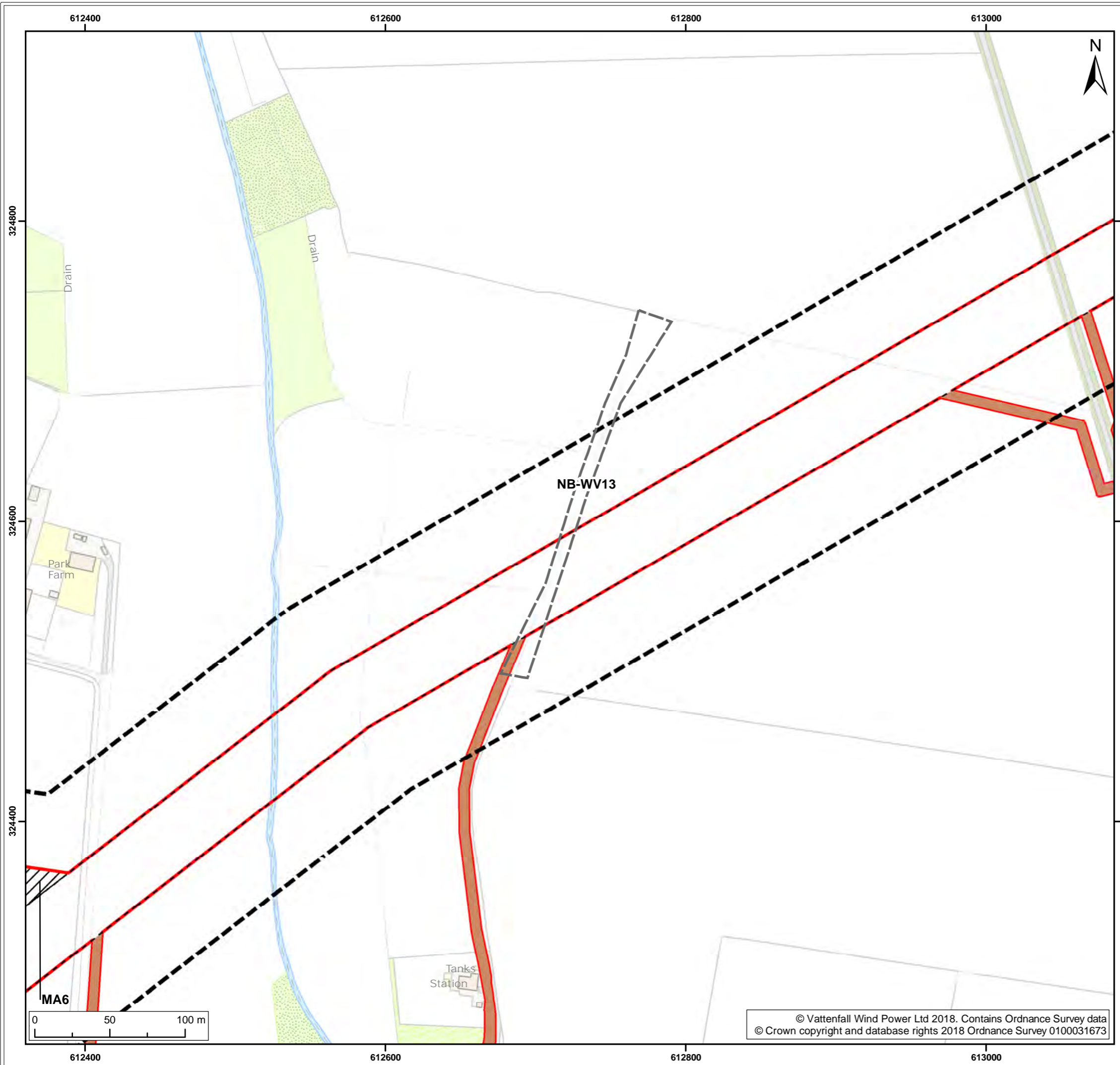
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Co-ordinate system: British National Grid **EPSG:** 27700

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Mobilisation zone
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area) (no access)

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water Vole Survey results
(Map 3 of 10)

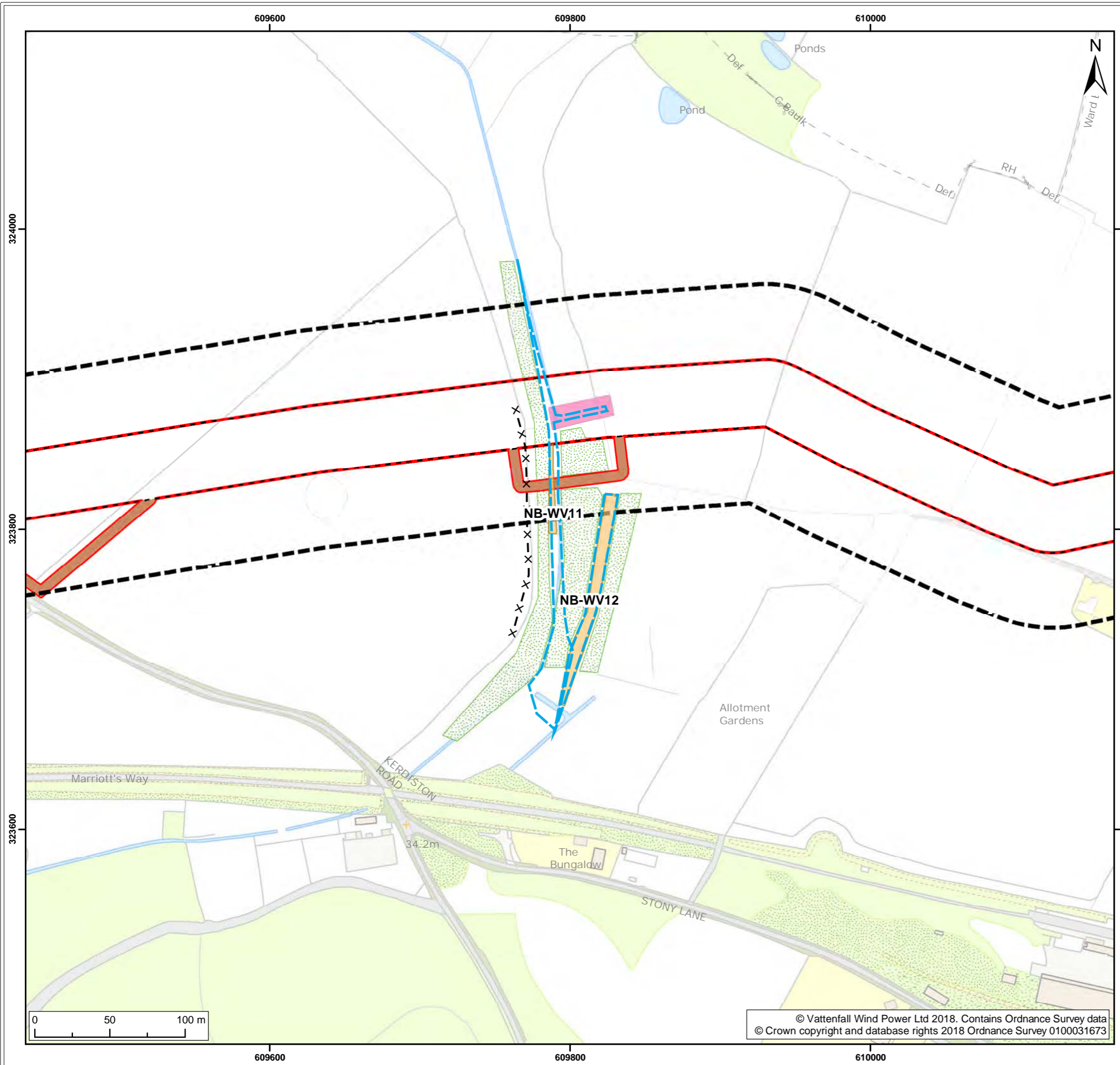
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02	09/08/2018	JT	GC	A3	1:2,500

Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)
- Bankside feature**
- x - x Fence
- Reedbeds
- Location of other features**
- Culvert
- Adjacent land use**
- Rough Pasture

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water Vole Survey results
(Map 4 of 10)

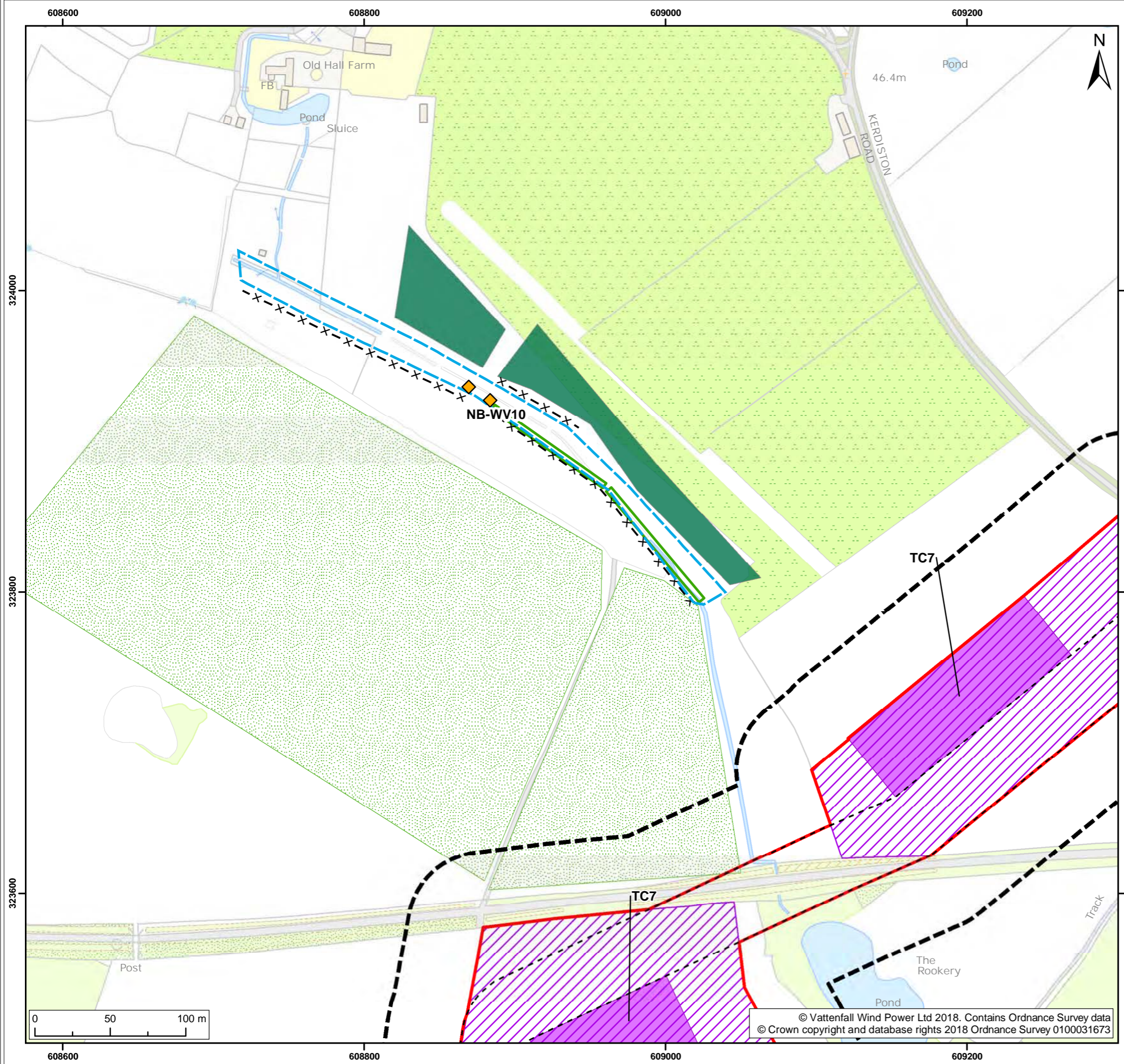
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)
- Water Vole field signs**
- ◆ Burrows
- Bankside feature**
- X - X - X Fence
- Hedgerow
- Adjacent land use**
- Broadleaved woodland
- Rough Pasture

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water Vole Survey results
(Map 5 of 10)

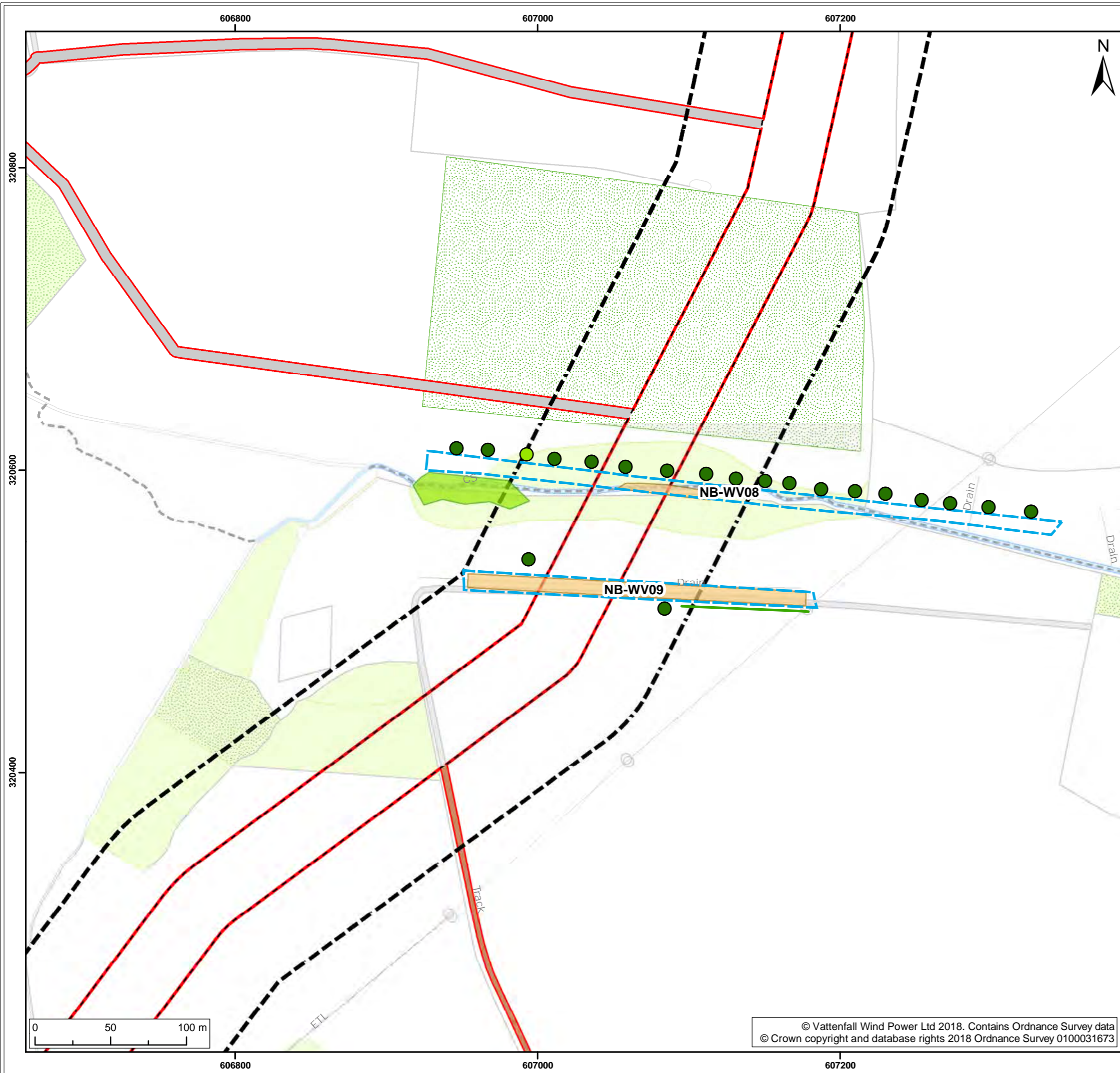
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)
- Bankside vegetation**
- Exposed roots
- Mature tree
- Hedgerow
- Scrub area
- Reedbeds
- Adjacent land use**
- Rough Pasture

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

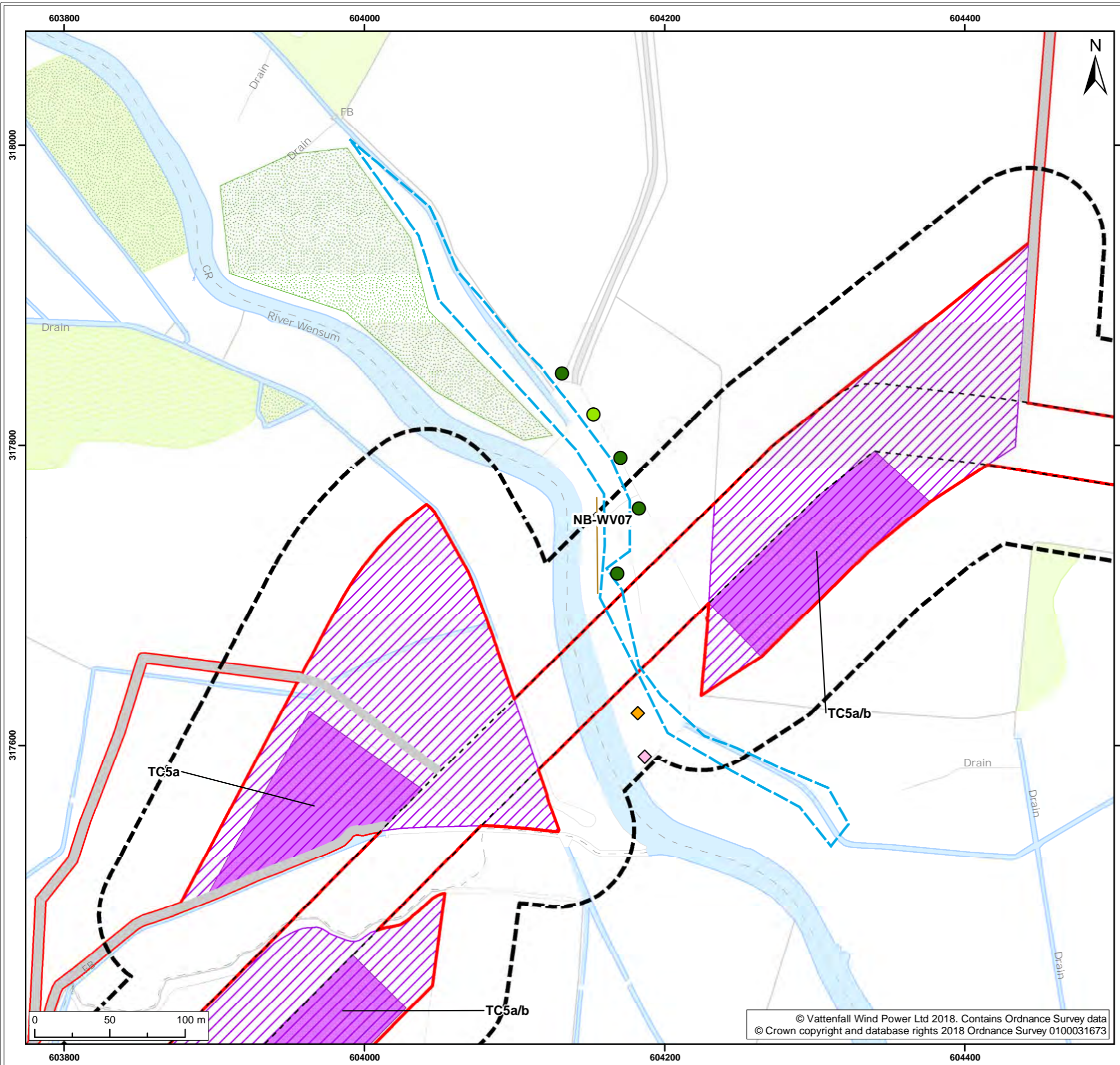
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(Map 6 of 10)

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02	09/08/2018	JT	GC	A3	1:2,500

Co-ordinate system: British National Grid **EPSG:** 27700



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- Legend:**
- Norfolk Boreas red line boundary
 - Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Construction access
 - Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Trenchless crossing zone (e.g. HDD)
 - Indicative trenchless crossing compound
 - Survey areas**
 - Habitats and species study area
 - Water Vole survey extent (2018 survey area)
 - Water Vole field signs**
 - ◆ Burrows
 - ◇ Pathway in vegetation
 - Bankside feature**
 - Earth cliff
 - Bankside vegetation**
 - Exposed roots
 - Mature tree
 - Adjacent land use**
 - Rough Pasture

Project:	Report:
Norfolk Boreas	Water Vole Survey report

Title:

Water Vole Survey results
(Map 7 of 10)

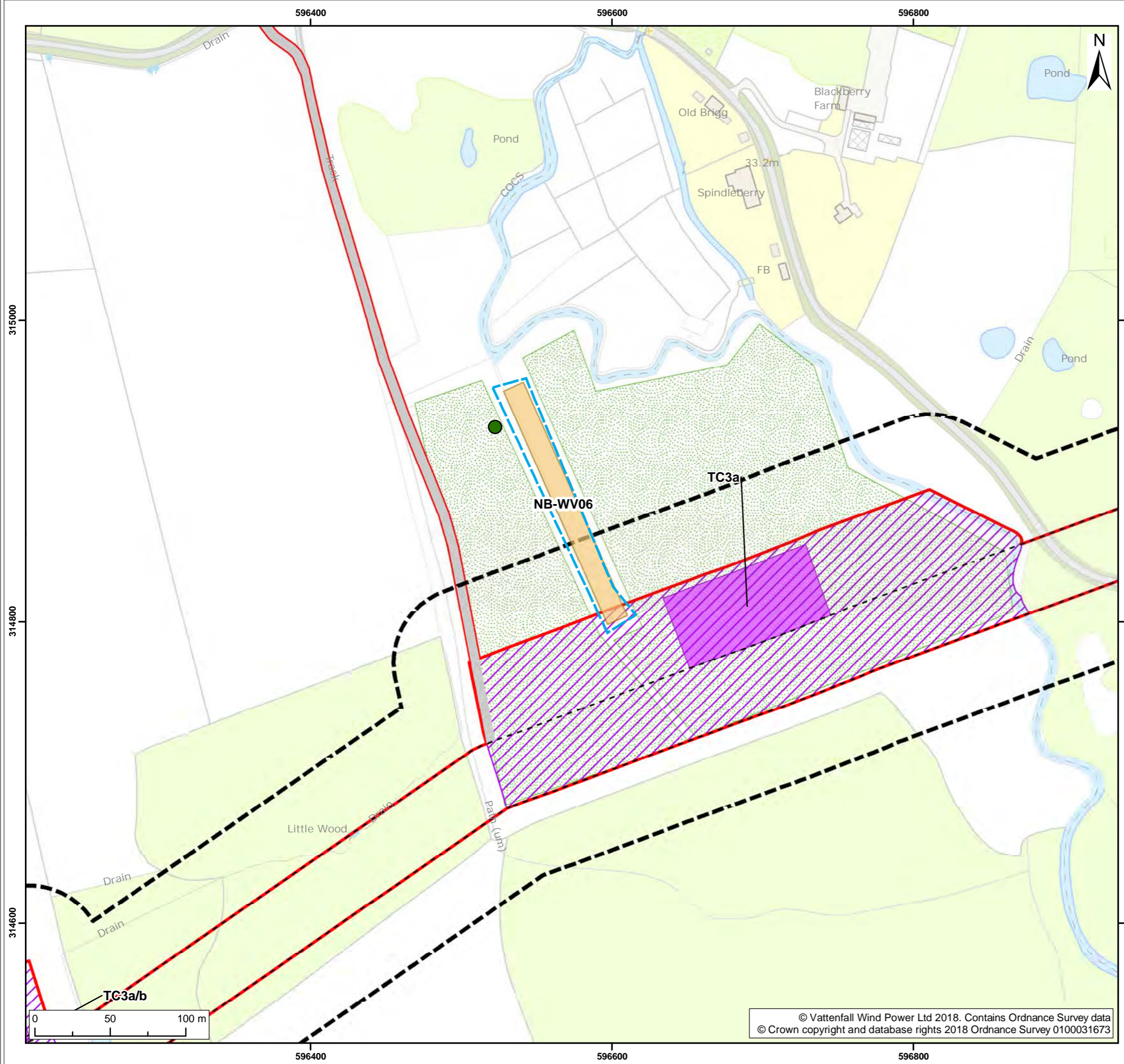
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

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- Onshore cable route
- Construction access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)
- Bankside vegetation**
- Mature tree
- Reedbeds
- Adjacent land use**
- Rough Pasture

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

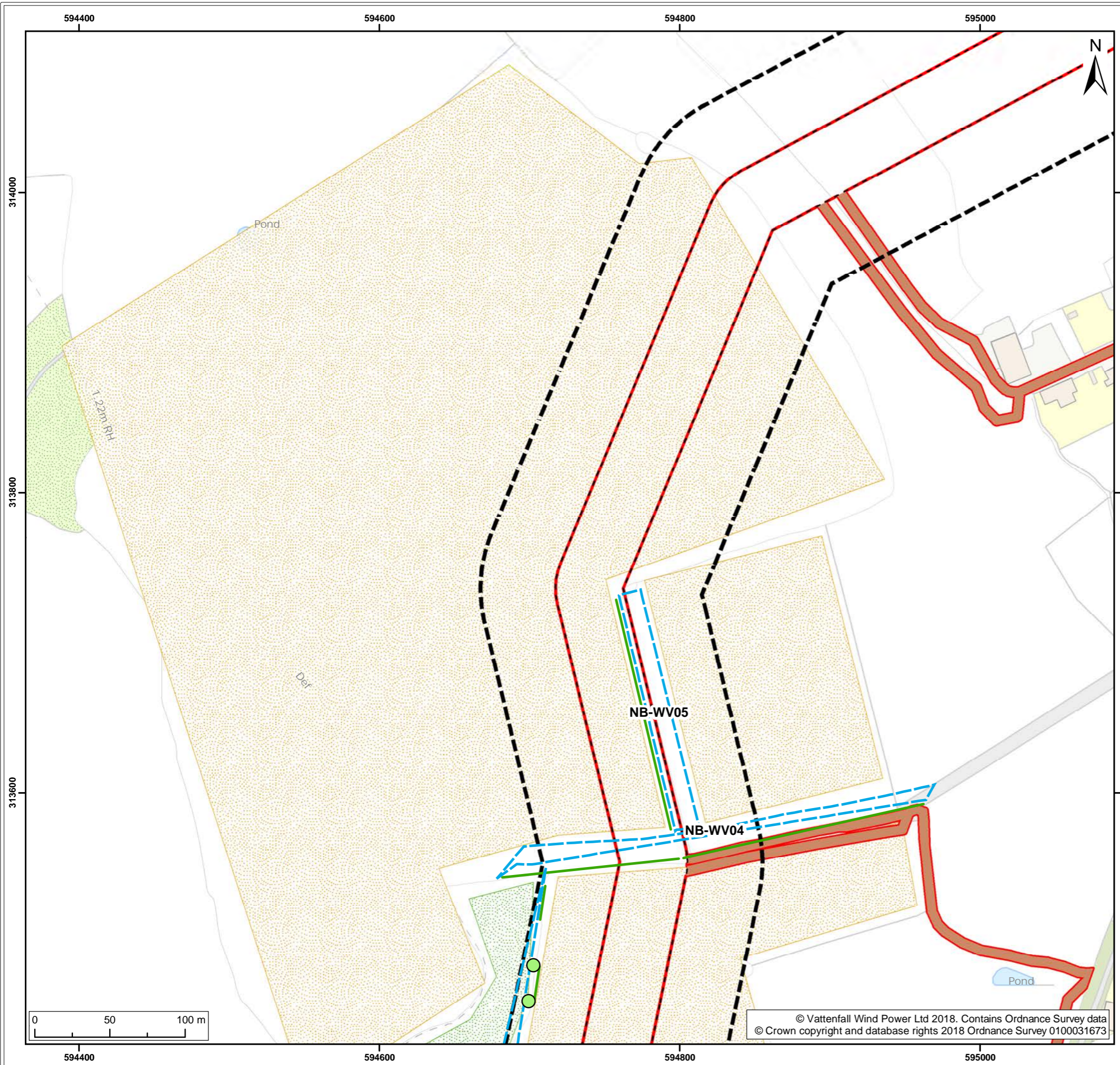
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Water Vole Survey results
(Map 8 of 10)

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02	09/08/2018	JT	GC	A3	1:2,500

Co-ordinate system: British National Grid EPSG: 27700



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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Operational access
- Survey areas**
- Habitats and species study area
- Water Vole survey extent (2018 survey area)
- Bankside vegetation**
- Saplings
- Hedgerow
- Adjacent land use**
- Rough Pasture
- Tilled land crop

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water Vole Survey results
(Map 9 of 10)

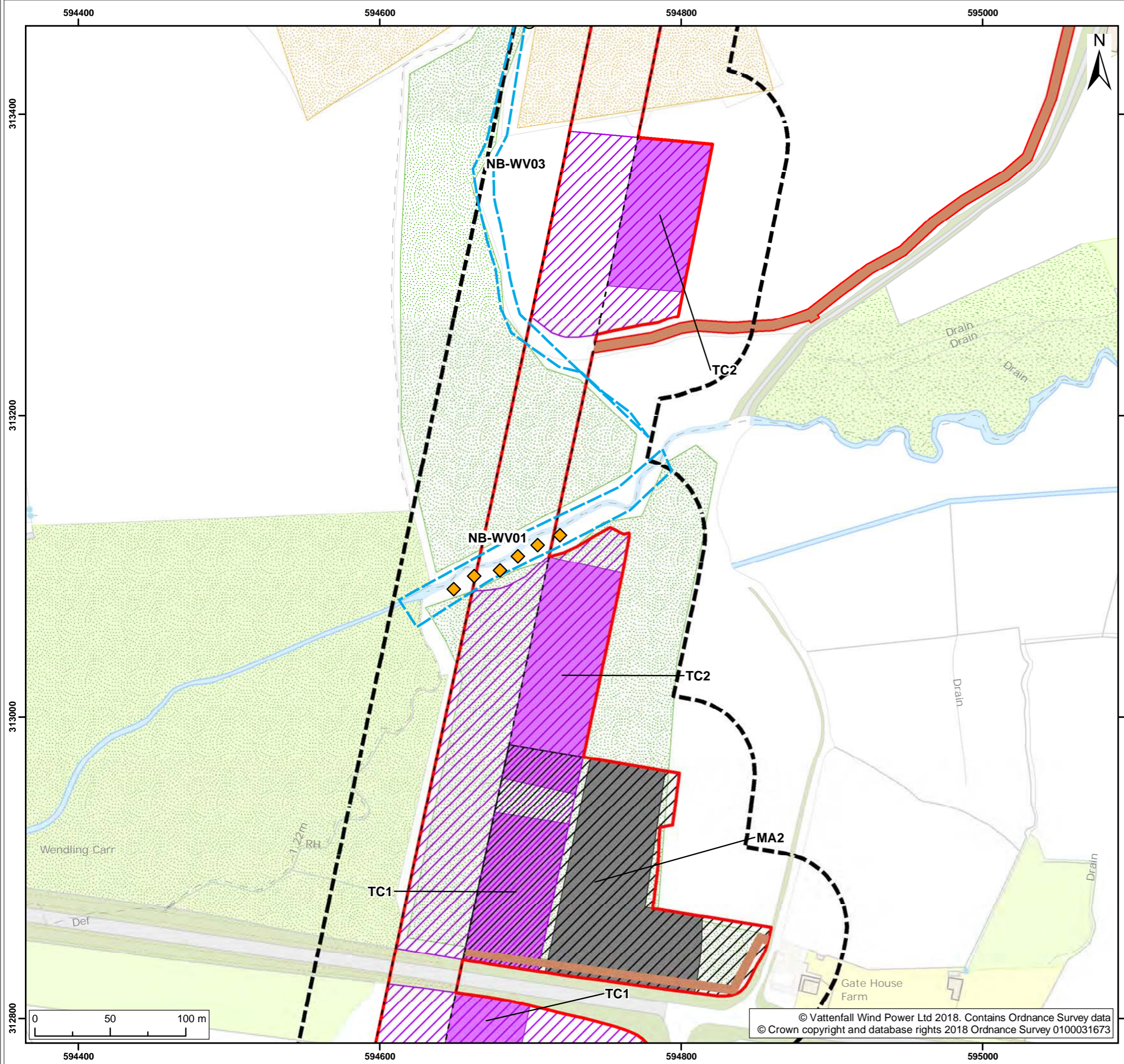
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Co-ordinate system: British National Grid EPSG: 27700

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- Legend:**
- Norfolk Boreas red line boundary
 - Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Operational access
 - Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Trenchless crossing zone (e.g. HDD)
 - Indicative trenchless crossing compound
 - Mobilisation zone
 - Indicative mobilisation area compound
 - Survey areas**
 - Habitats and species study area
 - Water Vole survey extent (2018 survey area)
 - Water Vole field signs**
 - ◆ Burrows
 - Bankside vegetation**
 - Saplings
 - Adjacent land use**
 - Rough Pasture
 - Tilled land crop

Project: Norfolk Boreas	Report: Water Vole Survey report
----------------------------	-------------------------------------

Title:
Water Vole Survey results
(Map 10 of 10)

Figure: 22.3.3		Drawing No: PB5640-005-0223-003			
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Co-ordinate system: British National Grid EPSG: 27700

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9 Annex B: Full Water Vole Survey Results

Table 9.1 shows the full watercourse assessment results for all watercourses surveyed in 2018.

Table 9.1 Full 2018 Water Vole Survey results

WV Survey Reference	Surveyors	Date	Weather conditions	Waterbody type	Bank composition	Land use	Bankside trees	Bushes	Herbs	Submerged weed	Reeds/sedges	Tall grass	Short grass	Disturbance	Bank profile	Depth	Width	Current	Latrines (count)	Burrows (count)	Sightings (count)	Footprints	Pathways	Feeding remains	Lawns	Rat field signs	Otter field signs	Mink field signs	Additional comments
NB-WV01	MW /CC	23.04.18		Ditch	Earth, earth cliffs	Permanent/temporary grass, arable crop	Rare	Rare	Frequent	Frequent	None	Frequent	Frequent	None	Steep > 45o	< 0.5m	2-5m	Fast	1	6				1					Ditch and arable grassland on both sides, nettle, grasses, common hogweed, burrows in bank, curled dock, water soldier, water lobelia. Food sources (plenty), butterbur, feeding station(?), ditch has signs of erosion, RHB undercut. Marsh marigold, white dead nettle.
NB-WV03	MW /CC	23.04.18		Ditch	Earth	Arable crop, permanent/temporary grass	Rare	Frequent	Frequent	Rare	Rare	Frequent	Frequent		Steep > 45o	< 0.5m	1-2m	Slow											Dry ditch, dense veg, remains dry most of the year, defunct hedge on one side, grassland, hawthorn, bramble, primrose, lesser periwinkle, water lobelia. Suboptimal for water-vole. Only greater stitchwort grass and ivy.
NB-WV04	MW /CC	23.04.18		Ditch	Earth, earth cliffs	Arable crop	Rare	Frequent	Frequent	Rare	Rare	Frequent	Frequent	None	Steep > 45o	< 0.5m	1-2m	Static											Dry ditch, steep banks, grassy banks, clover, common hogweed, red dead-nettle, common nettle, bramble, dog's mercury, intact hawthorn hedge, shady, dry most of the year, greater stitchwort.
NB-WV05	MW /CC	23.04.18		Ditch	Earth, earth cliffs	Arable crop	Rare	Frequent	Frequent	Rare	Rare	Frequent	Frequent	None	Steep > 45o	< 0.5m	1-2m	Static											Ditch, hedge on one side, hawthorn, bramble, goat willow, annual mercury, common nettle, common hogweed, greater stitchwort, soft rush, common duckweed, poor water quality, silty (run-off from fields) optimal for voles, but no sign of presence, water mint.
NB-WV06	MW /CC	23.04.18		Ditch	Earth, silt, sand	Permanent/temporary grass, cattle grazing	Rare	Rare	Frequent	Dominant	Dominant	Frequent	Frequent	None	Steep > 45o	< 0.5m	5-10m	Static											Shallow ditch overgrown, with reeds, mostly common reed, silted, poor water quality, limited material for burrowing, common nettle, lady's smock, dock, thistle, bull rush, grasses, suboptimal for water vole.
NB-WV07	MW /CC	23.04.18		Ditch	Stones, gravel, sand, silt	Permanent/temporary grass, mixed broadleaf woodland	Frequent	Frequent	Frequent	Rare	Rare	Rare	Frequent	None	Steep > 45o	< 0.5m	2-5m	Fast		1			1						Ditch at the edge of the woodland (bar), gravelly bed in places limited in channel vegetation, mostly water mint, shaded, water-cress, fool's water-cress, tall sedges. Bank, hawthorn, hazel, pine, oak, gorse, white dead-nettle, red dead-nettle, wool sorrel, herb robert, common nettle, common hogweed, marsh marigold, optimum for water vole. Some pathways, no other signs. Optimal for otter.
NB-WV08	MW /CC	23.03.18		Runni ng water	Stones, gravel, sand, silt	Permanent/temporary grass, arable crop, mixed broadleaf woodland	Dominant	Frequent	Frequent	Rare	Rare	Frequent	Frequent	None	Steep > 45o	< 0.5m	5-10m	Fast											Fast flowing river gravel bars, banks (earth suitable for burrowing). The edge of a woodland hazel, beech, oak, alder, ivy, LWD, common nettle, annual, annual mercury, common hogweed, white dead nettle, marsh marigold, hawthorn, curled dock, some in-channel vegetation, common reed, soft rush, bramble and primrose.
NB-WV09	MW /CC	23.04.18		Ditch	Earth	Permanent/temporary grass, cattle grazing	Rare	Rare	Dominant	Dominant	Rare	Dominant	Dominant	None	Shallow < 45o	< 0.5m	1-2m	Static											Shallow ditch, grassland both sides, moderate water quality, some trees and shrubs on both banks, hawthorn, willow, bramble, dog rose, common nettle, dandelions, grasses, common hogweed, dense in channel vegetation, soft rush, herb robert, bulrush.

WV Survey Reference	Surveyors	Date	Weather conditions	Waterbody type	Bank composition	Land use	Bankside trees	Bushes	Herbs	Submerged weed	Reeds/sedges	Tall grass	Short grass	Disturbance	Bank profile	Depth	Width	Current	Latrines (count)	Burrows (count)	Sightings (count)	Footprints	Pathways	Feeding remains	Lawns	Rat field signs	Otter field signs	Mink field signs	Additional comments
NB-WV10	MW/CC	23.04.18		Ditch	Earth, earth cliffs	Cattle/grazing, permanent/temporary grass, bank fenced	Rare	Frequent	Frequent	Rare	Rare	Frequent	Frequent	None	Steep > 450	< 0.5m	2-5m	Fast		7			1						Very steep banks, bramble, ivy, hawthorn, annual mercury, clover, broad-leaved dock, common hogweed, marsh marigold, common nettle, hazel, herb robert, grasses, poor water quality, lady's smock, greater stitchwort, two potential burrows and pathway, water mint, water lobelia.
NB-WV11	MW/CC	23.04.18		Ditch	Earth	Permanent/temporary grass	Rare	Frequent	Abundant	Abundant	Frequent	Dominant	Dominant	None	Shallow < 450	0.5-1m	2-5m	Static										Shallow ditch, low water level, grassy bank, dandelion, herb robert, water mint, gorse, soft rush, broad leaved dock, water lobelia, wild cherry, nettle, hawthorn, bramble, red dead-nettle, dog violet, some sections no access (dense bramble), stitchwort, ground speedwell, ditch broken with upper section dense gorse and bramble (no access).	
NB-WV12	MW/CC	23.04.18		Ditch	Earth	Permanent/temporary grass	Rare	Rare	Dominant	Frequent	Frequent	Dominant	Dominant		Shallow < 450	< 0.5m	1-2m	Sluggish										Shallow ditch, dry in places, dense vegetation mostly soft rush (more marsh than ditch in places), water lobelia, water mint, dandelion, dock, meadow buttercup, marsh marigold, grasses, suboptimal for water voles.	
NB-WV15	MW/CC	24.04.18		Ditch	Earth, silt	Permanent/temporary grass	Rare	Rare	Frequent	Dominant	Dominant	Frequent	Frequent	None	Steep > 450	< 0.5m	1-2m	Static										Ditch, grassland both sides, species poor hedge on site, common reed present in the channel, silted, soft rush. Bank: holly, hawthorn, common nettle, field maple, creeping willow, silver birch, bramble, dock spp.	
NB-WV16	MW/CC	24.04.18		Running water, ditch	Earth, silt, sand, earth cliffs	Arable crop, permanent/temporary grass	Frequent	Frequent	Frequent	Dominant	Dominant	Rare	Dominant		Steep > 450	< 0.5m	2-5m	Fast										Steep bank, earth cliffs, fast flowing river, evidence of erosion of both banks, LHB more stable (trees), runoff from fields, silty but moderate water quality, small areas of reeds (common reed), not a lot of in channel vegetation. Banks: hawthorn, bramble, silver birch, oak, dock, grasses, gorse.	
NB-WV17 & NB-WV18	MW/CC	24.04.18		Ditch	Sand, silt, earth	Permanent/temporary grass	Rare	Frequent	Frequent	Frequent	Dominant	Frequent	Dominant		Steep > 450	< 0.5m	2-5m	Static										In between grassland (sheep present), short bramble on both banks, dense in channel vegetation (reeds, mare's tail) soft rush, one silver birch, silty, moderate water quality, runoff from fields. Forms part of 16 - 1.5m deep and 17 - 0.5m deep.	

10 Annex C: Plates

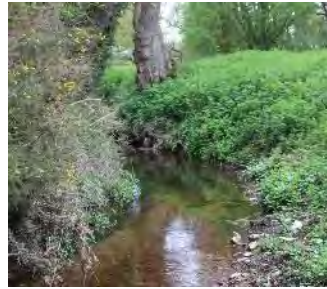
60. Table 10.1 contains the plates recorded for each watercourse surveyed during the 2018 surveys showing the watercourse survey area and any field signs, if observed.

Table 10.1 Plates for 2018 Water Vole Survey

Water-course	Plate
NB-WV01	
NB-WV02	
NB-WV03	

NB-WV04			
NB-WV05			

NB-WV06



<p>NB-WV07</p>		 
<p>NB-WV08</p>		
<p>NB-WV09</p>	 	 

<p>NB-WV10</p>			
<p>NB-WV11</p>			
<p>NB-WV14</p>			
<p>NB-WV15</p>			

NB-WV16 &
NB-WV17



Norfolk Vanguard Offshore Wind Farm

Water Vole Survey Report Environmental Statement

Document Reference: PB4476-005-0223

Date: June 2018 Author: Royal HaskoningDHV



Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
01/05/18	01D	Issue to Norfolk Vanguard Limited review	GC	CS/RH	JA
25/05/18	01F	Final for ES submission	GC	CS/RH	JA

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Figures

Figure 1 Survey location

Figure 2 Water bodies screened into further survey

Figure 3 Water vole survey results

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Glossary

AfL	Agreement for Lease
CIEEM	Chartered Institute of Ecology and Environmental Management
CRS	Cable Relay Station
DCO	Development Consent Order
EAOW	East Anglia Offshore Wind
EIA	Environmental Impact Assessment
ES	Environmental Statement
HDD	Horizontal Directional Drilling
HVDC	High Voltage Direct Current
PEIR	Preliminary Environmental Information Report
SPR	Scottish Power Renewables (UK) Limited
VWPL	Vattenfall Wind Power Ltd
ZDA	Zone Development Agreement

Terminology

Cable Relay Station	Primarily comprised of an outdoor compound containing reactors (also called inductors, or coils) and switchgear to increase the power transfer capability of the cables under the HVAC technology scenario as considered in the PEIR. This is no longer required for the project as the HVDC technology has been selected.
Landfall	Where the offshore cables come ashore at Happisburgh South
Mobilisation area	Areas approx. 100 x 100m used as access points to the running track for duct installation. Required to store equipment and provide welfare facilities. Located adjacent to the onshore cable route, accessible from local highways network suitable for the delivery of heavy and oversized materials and equipment.
Mobilisation zone	Area within which the mobilisation area will be located.
National Grid new / replacement overhead line tower	New overhead line towers to be installed at the National Grid substation.
National Grid overhead line modifications	The works to be undertaken to complete the necessary modification to the existing 400kV overhead lines
National Grid substation extension	The permanent footprint of the National Grid substation extension
National Grid temporary works area	Land adjacent to the Necton National Grid substation which would be temporarily required during construction of the National Grid substation extension.
Necton National Grid	The existing 400kV substation at Necton, which will be the grid connection

substation	location for Norfolk Vanguard
Onshore cable corridor	200m wide onshore corridor within which the onshore cable route would be located as submitted for PEIR.
Onshore cable route	The 45m easement which will contain the buried export cables as well as the temporary running track, topsoil storage and excavated material during construction.
Onshore cables	The cables which take the electricity from landfall to the onshore project substation
Onshore project area	All onshore electrical infrastructure (landfall; onshore cable route, accesses, trenchless crossing technique (e.g. Horizontal Directional Drilling (HDD)) zones and mobilisation areas; onshore project substation and extension to the Necton National Grid substation and overhead line modification)
Onshore project substation	A compound containing electrical equipment to enable connection to the National Grid. The substation will convert the exported power from HVDC to HVAC, to 400kV (grid voltage). This also contains equipment to help maintain stable grid voltage.
Onshore project substation temporary construction compound	Land adjacent to the onshore project substation which would be temporarily required during construction of the onshore project substation.
The project	Norfolk Vanguard Offshore Wind Farm, including the onshore and offshore infrastructure

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22 WATER VOLE SURVEY REPORT

22.1 Introduction

1. The aim of this report is to present the findings of a water vole *Arvicola amphibius* presence/absence survey (herein the 'Water Vole Survey') conducted with respect to the Norfolk Vanguard Offshore Wind Farm (herein referred to as the 'project') onshore project area.

22.1.1 Project Background

2. In December 2009 as part of the UK Offshore Wind Round 3 tender process, The Crown Estate awarded the joint venture company, East Anglia Offshore Wind (EAOW) Ltd, the rights to develop Zone 5 (later called the 'East Anglia zone'). These rights were granted through a Zone Development Agreement (ZDA). EAOW Ltd. is a 50:50 joint venture owned by Vattenfall Wind Power Ltd (VWPL) and ScottishPower Renewables (UK) Limited (SPR).
3. Under the ZDA, the joint venture consented East Anglia ONE, and commenced the Environmental Impact Assessments (EIA) for East Anglia THREE (prior to the project being taken forward to submission by SPR) and East Anglia FOUR (up to submission of a request for Scoping Opinion in 2012).
4. In December 2014, a decision was taken to split the zone, with VWPL having development rights within the north of the former East Anglia Zone, and SPR continuing to develop the southern part. In agreement with The Crown Estate, the ZDA was effectively dissolved in 2016. New Agreement for Lease (AfL) areas have been awarded by The Crown Estate within the former Zone, separately to VWPL and its affiliate companies, and SPR and its affiliates.
5. VWPL are now developing plans for the northern half of the zone, which is split into two development areas: Norfolk Vanguard and Norfolk Boreas. Norfolk Vanguard will have a capacity of 1800MW which is enough to power 1.3 million UK households¹. Norfolk Vanguard Limited (an affiliate company of VWPL) is now undertaking the Environmental Impact Assessment (EIA) and Environmental Statement (ES) for Norfolk Vanguard and a Scoping Report was submitted to the Planning Inspectorate in October 2016 (Royal HaskoningDHV, 2016).
6. Norfolk Vanguard is a National Significant Infrastructure Project (NSIP) and as such is subject to a Development Consent Order (DCO) process in order to obtain planning permission. An EIA is required as part of a DCO application under the Planning Act

¹ assuming a load factor of 34.88 <http://www.renewableuk.com/page/UKWEDEexplained>

2008. In order to inform the ES, ecological baseline data is required with respect to the onshore project area. This report represents part of that ecological baseline.

22.1.2 Site Description

7. The onshore electrical infrastructure works for the project currently consists of the following key elements:
 - Landfall;
 - Cable relay station (CRS) (no longer required);
 - Onshore cable corridor;
 - Onshore substation; and
 - Extension to the existing Necton National Grid substation including overhead line modifications.
8. The location of the onshore project area is shown on Figure 1, Annex A: Figures. During the development of the project, the onshore Scoping Area that was initially defined has been refined, to identify three landfall options, associated CRS zones, as well as an onshore substation search zone in proximity to the Necton National Grid substation, and modifications to the existing overhead lines. A 200m wide onshore cable corridor has been identified, within which the cable will be located, and trenchless crossing techniques (e.g. Horizontal Directional Drilling (HDD)) zones and mobilisation zones have been identified along the onshore cable corridor. The surveys undertaken for Water Vole were designed and based on the project infrastructure and search zones at that time (March 2017). As the project design is further refined, these search zones will decrease in size, and the final options for the siting of infrastructure (i.e. one landfall, refined onshore cable route, one onshore project substation) will be taken forward.
9. For more details of the project as submitted for the ES, see Chapter 5 Project Description. Norfolk Vanguard Limited have selected the High Voltage Direct Current (HVDC) technology, removing the requirement for the CRS from the project, however as this report details a survey done at a specific moment in time, reference to these areas remains in this document.

22.1.3 Purpose and Scope of this Report

10. An Extended Phase 1 Habitat Survey of the project area was undertaken during February 2017. The findings are reported Appendix 22.1. The Extended Phase 1 Habitat Survey identified the potential for legally protected species located within the project area plus a 50m buffer surrounding the onshore project area (herein the 'Extended Phase 1 Habitat Survey area').

11. The Extended Phase 1 Habitat Survey involved a preliminary assessment of all watercourses within the survey area for their potential to support water voles. A total of 38 watercourses were assessed during the Extended Phase 1 Habitat Survey, of which 31 were identified as being of optimal habitat and the remaining seven were assessed as being sub-optimal. Those assessed as sub-optimal were classified in this way primarily due to the watercourse having very little bank for burrowing, very poor water quality observed, very shallow banks, low flows, evidence of regular channel maintenance or isolation from any connecting habitat. Following the Extended Phase 1 Habitat Survey, a detailed water vole presence/absence survey of the 31 watercourses identified as providing optimal suitability to support water voles was proposed.
12. This report presents the findings of the Water Vole Survey conducted by Royal HaskoningDHV ecologists in May and June 2017. This report has been prepared in order to inform the project PEIR.
13. The scope of this Water Vole Survey included the 31 watercourses identified during the Extended Phase 1 Habitat Survey, plus two additional watercourses for which survey access has been granted since the Extended Phase 1 Habitat Survey. Therefore, in total 33 watercourses have been scoped into this Water Vole Survey.
14. The findings of this report will provide details of the water vole resource present within the Water Vole Survey area. This will be used to inform the ongoing environmental impact assessment (EIA) process for the project and to identify any outline mitigation measures and licensing requirements which may be required.
15. This report has been prepared in line with the guidelines as set out in the Chartered Institute of Ecology and Environmental Management's (CIEEM) Guidelines on Ecological Report Writing (2nd Edition, December 2015).

22.1.4 Consultation

16. The methodology set out in this report was issued on 17th March 2017, as part of the project Evidence Plan Process to the following stakeholders for comment:
 - Natural England;
 - Environment Agency;
 - Breckland Council;
 - Norfolk County Council; and
 - Norfolk Wildlife Trust.
17. Feedback was received from Norfolk County Council and Natural England on the 23rd March 2017 and 3rd April 2017 confirming that the methodology and approach to surveys was appropriate and acceptable.

22.2 Legislation and Policy

18. Table 22.1 summarises the relevant information regarding the legal protection afforded to water voles. However it should be noted that this is for information only and is not intended to be comprehensive or to replace specialised legal advice.

Table 22.1 Summary of the key legislation and policy relevant to water voles

Legislation	Relevance
Wildlife and Countryside Act 1981 (as amended)	This Act makes it an offence to intentionally kill, injure or take any animal listed in Schedule 5 of the Act and protects occupied and unoccupied places used for shelter or protection. Water voles are listed on Schedule 5.
Natural Environment and Rural Communities Act 2006	Section 41 of the Act requires the Secretary of State to compile a list of habitats and species of principal importance for the conservation of biodiversity in England. Decision makers of public bodies, in the execution of their duties, must have regard to the conservation of biodiversity in England, and the list is intended to guide them. Natural England have compiled a list of species of Principal Importance. Water voles are on this list.
Policy	Relevance
UK Post-2010 Biodiversity Framework	Supersedes the UK Biodiversity Action Plan (UK BAP), which fulfilled legal obligation under the Convention on Biological Diversity to identify and produce action plans for produce priority habitats and species.

22.3 Methodology

22.3.1 Survey Area

19. The Water Vole Survey covered all watercourses identified during the Extended Phase 1 Habitat Survey as suitable for supporting water voles. The survey area for each watercourse included the extent within the onshore project area plus a 50m buffer upstream and downstream. Collectively, the surveys areas for each watercourse are referred to as the survey area (as shown on Figure 2, Annex A: Figures).

22.3.2 Survey Methodology

20. A Water Vole Survey was undertaken on four dates between mid-May and mid-June 2017, with surveys conducted on the 17th May, 18th May, 1st June and the 20th June 2017.

21. A total of 31 watercourses were subject to a water vole presence/absence survey (out of 33 scoped into the survey) in order to confirm whether or not water voles are present. These included 29 watercourses identified during the Extended Phase 1 Habitat Survey as having the potential to support water voles plus two watercourses identified using the Norfolk Living Map as potentially suitable for water voles. Two watercourses were not surveyed due to landowners restrictions encountered during the Water Vole Survey (discussed further in section 22.3.5).
22. The Water Vole Survey was undertaken in accordance with the methodology set out in the Water Vole Conservation Handbook (3rd Ed.) (Strachan, Moorhouse and Gelling, 2011) and as modified by The Water Vole Mitigation Handbook (Dean *et al.*, 2016). Surveys were conducted on one bank for the full length of each optimal watercourse within the survey area (i.e. within the project area, plus 50m upstream and 50m downstream). Each watercourse was assessed in 100m sections. Each 100m section was walked by an ecologist, and all field signs of water vole were recorded. This included sightings, burrows, latrines, feeding stations, lawns, nests, footprints and runways. The field sign type, its location were recorded and a photograph taken for each field sign observed. In addition to all water vole field signs, field signs of other aquatic mammals (e.g. rats, otter and mink) were recorded. The habitats adjacent to the survey area were recorded and mapped. Detailed information on bankside species and watercourse characteristics were recorded for each watercourse during the Extended Phase 1 Habitat Survey, and this information has been revised and updated during the Water Vole Survey where conditions have changed.
23. The survey involved one visit during the mid-April – June survey season, when water voles are breeding but vegetation is not too dense to observe field signs. A second visit was not considered to be required for any of the watercourses surveyed, as the assessment of the effects on water voles can be made on a precautionary basis for all watercourses assessed, and all surveys were conducted during the optimum period within the water survey season (mid-April – June), when vegetation was low but weather conditions had allowed for a consistent period of activity prior to surveys.
24. Weather conditions were recorded during the survey.

22.3.3 Surveyors

25. The Water Vole Surveys were conducted by a team of four Royal HaskoningDHV ecologists. The survey team was led by Gordon Campbell, BA. (Hons) MSc, Associate Member of CIEEM (ACIEEM). Gordon has 4 years' experience of water vole surveying. The survey team included:

- Thomas Chillcott, BSc. MSc. Graduate Member of CIEEM (GradCIEEM);
- Maria Walentek, BSc. MSc. Associate Member of the Institute of Environmental Assessment (AIEMA);
- Charlotte Clements, BSc. Affiliate Member of the IEMA; and
- Jack Douglas, BSc. (Hons).

22.3.4 Weather Conditions

26. Table 22.2 summarises the weather conditions encountered during the survey period.

Table 22.2 Weather conditions

Date	Weather conditions
17 th May 2017	Humid, overcast, warm (20°C)
18 th May 2017	Dry, clear, warm (24°C)
1 st June 2017	Dry, overcast, warm (22°C).
20 th June 2017	Dry, overcast, warm (20°C).

22.3.5 Survey Limitations

27. To date, the survey team has covered all land to which landowner access permission has been granted. This included 31 of the 33 watercourses assessed as suitable to support water voles (as outlined in section 22.1.3). Surveys have not been possible to the remaining two watercourses (WV16 and WV25) due to landowner access restrictions. If landowner access becomes available for these watercourses during the 2017 survey season (mid-April to October inclusive), surveys will be undertaken at these watercourses.
28. There are estimated to be a further 10 watercourses which fall within the survey area but to which landowner access has not been granted. It should be noted that these watercourses will be surveyed during future survey seasons, when full landowner access is obtained.
29. For a further six watercourses (namely WV04, WV06, WV12, WV13, WV20, WV30), some areas of the watercourse could not be fully accessed during the Water Vole Survey, due to physical barriers preventing entry (i.e. dense vegetation cover). However these areas were encountered infrequently and where they were, they were recorded as potentially providing field signs which could not be picked up during the Water Vole Survey.

30. Heavy rain on the evening of 17th May 2017 may have affected the number of field signs present during surveys in the 18th May 2017. Fields signs of water vole were still successfully recorded during surveys on the 18th May 2017, so the impact of the rain of field sign integrity is unlikely to have been severe.
31. Whilst the survey team made the utmost effort to pick up all field signs present during the field survey, on occasion due to human error some field signs can be missed or overlooked. However despite this, the data presented in this report is considered to provide an accurate description of the habitats within the survey area and provide a robust understanding of the survey area's water vole population.

22.4 Results

22.4.1 Field Signs

32. Field signs of water vole were found in seven of the 31 watercourses surveyed during the 2017 Water Vole Survey. Field signs found included latrines, burrows, pathways, footprints and feeding remains.
33. In addition, a water vole sighting was made on 16th May 2017 during separate great crested newt surveys undertaken by the survey team adjacent to watercourse WV13.
34. Field signs of otter were observed at two watercourses, and field signs of rat were observed at two watercourses also.
35. No field signs of mink were observed during the survey.
36. A total of 11 watercourses were found to be completely dry during the Water Vole Survey and were reassessed as not suitable for supporting water voles. Consequently no surveys were undertaken of these watercourses.
37. Table 22.3 summarises the findings of the Water Vole Survey which has been undertaken to date. The full results from the Water Vole Survey are contained with Table 22.7 in Annex B: Water Vole Survey Results. The location of all the field signs recorded during the Water Vole Survey are shown on Figure 2, Annex A: Figures.

Table 22.3 Summary of the 2017 Water Vole surveys

Water course	Latrines	Burrows	Sightings	Footprints	Pathways	Feeding remains	Other field signs	Comments
WV01		1						None
WV02								None

Water course	Latrines	Burrows	Sightings	Footprints	Pathways	Feeding remains	Other field signs	Comments
WV03								None
WV04								Ditch mostly overgrown, most areas inaccessible. Runs observed in bank side, too large for water vole.
WV05		1						None
WV06								Ditch running through woodland. Mostly overgrown, overhanging branches and dense scrub. Mostly inaccessible. Low water levels (c5cm), rocky banks and substrate, limited burrowing opportunity
WV07	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							
WV08	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							
WV09	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							
WV10								None
WV11	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							
WV12								Water level very low at time of survey. Not all areas accessible for survey due to dense vegetation.
WV13		2	1					No detailed survey undertaken due to dense vegetation cover. One sighting recorded in pond adjacent to watercourse during related survey on 16th May 2017. <u>Further surveys will be attempted in 2017.</u>
WV14						1		None
WV15	2	3			1	2	1 otter spraint	None
WV32	15	5		1		14	2 rat feeding signs	None
WV16	Landowner access not possible at the time of survey. <u>Further surveys will be attempted in 2017 if landowner access granted.</u>							
WV17	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							
WV18	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							

Water course	Latrines	Burrows	Sightings	Footprints	Pathways	Feeding remains	Other field signs	Comments
WV19	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							
WV20							2 rat feeding signs	Majority of watercourse surveyed from within, however large sections impenetrable due to dense vegetation.
WV21	Ditch now fully dry and not suitable for WV. No detailed survey undertaken.							
WV22		1			2		1 otter spraint	Cows present in field on opposite bank. Runs may have been caused by swans/geese observed in the area.
WV33	Ditch unsuitable for water vole. No detailed survey undertaken.							
WV23								Water quality is poor.
WV24								Upper reaches not surveyed due to dense vegetation.
WV25	Landowner access not possible at the time of survey. <u>Further surveys will be attempted in 2017 if landowner access granted.</u>							
WV26								This ditch was mostly dry, with water in areas where scraping of channel has been undertaken.
WV27								Signs of recent scraping on bank edges. Bank substrate appears mostly too compacted to allow for WV burrowing.
WV28	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							
WV29	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							
WV30								Survey undertaken from both banks. Access west of point reference for site is difficult due to dense vegetation.
WV31	Ditch now fully dry and not suitable for water vole. No detailed survey undertaken.							

22.4.2 Relative Population Size

38. The numbers of latrines found during each survey can be used to calculate an indication of population size (Dean *et al.*, 2016). Table 22.4 shows the values of latrine density which can be used to give an estimate of population size (note that

these values are most useful more indicating where the key areas within a survey area are).

Table 22.4 Calculation of estimated population size based on latrine numbers (adapted from Dean *et al.*, 2016)

Reference Number	Approximate number of latrines per 100m of bankside habitat	
	First half of survey season (mid-April to end of June)	Second half of survey season (July to September)
High	10 or more	20 or more
Medium	3-9	6-19
Low	≤2 (or none, but with other confirmatory field signs)	≤5 (or none, but with other confirmatory field signs)

39. Using the guidelines in Table 22.4, an estimate to the population density of each 100m section of each watercourse surveyed has been undertaken. The results are shown in Table 22.5 below. Only watercourses where presence was recorded have been included.

Table 22.5 Water vole population density

Water-course	Maximum number of latrines with a 100m section	Other field signs	Highest population density recorded within watercourse
WV01	0	Yes	Low
WV05	0	Yes	Low
WV13	0	Yes	Low
WV14	0	Yes	Low
WV15	2	Yes	Low
WV32	15	Yes	High
WV22	0	Yes	Low

40. One watercourse (WV32, the River Wensum at Elsing) returned a maximum estimated high population density, while the other six watercourses where evidence of water voles has been recorded returned a maximum estimated high population density. Within watercourse WV32, the population density varied between low and high throughout the area surveyed.

22.4.3 Habitats

41. The adjacent habitats found throughout the survey area were typically agricultural in nature, with arable crops and cattle grazing being the most common adjacent land use types recorded. The function of the watercourses surveyed also reflected the predominantly agricultural nature of the environment, as the majority were artificial field drainage ditches. Natural watercourses such as the River Wensum (at Dillington and at Swanton Morley) and the River Bure were also surveyed, as were other artificial watercourses (such as the Dilham Canal). Bankside habitat varied, with short grasses banks in areas of pastoral grazing, dense scrub and hedgerow covers at some drainage ditches and a mixture of marginal vegetation in other areas. A full summary of the habitat types found during the survey is contained within Table 22.7 in Annex B: Water Vole Survey Results.
42. The habitats adjacent to each survey area recorded during the Water Vole Survey are shown on Figure 2, Annex A: Figures.

22.5 Recommendations

43. The results of the Water Vole Survey, as outlined in section 22.4, showed that there are seven watercourses within the survey area in which presence of water voles has been confirmed. Of these, one contained areas where relative water vole population density is high; the other six watercourses contained only areas of low or lower water vole density.

22.5.1 Potential Impacts

44. Given the population of water voles recorded during the Water Vole Survey, consideration of the potential impacts of the project upon water voles will be required in order to ensure that adequate steps are taken to minimise the risk of killing or injuring any water vole or damaging any water vole burrows during construction. Specifically, the following potential impacts should be considered in detail:
 - Habitat loss and deterioration;
 - Habitat fragmentation;
 - Incidental mortality during site clearance and construction;
 - Damage to burrows;
 - Introduction of domestic predators;
 - Change in management regime;
 - Pollution; and
 - Change in water level.

45. If any impacts are identified, the options for mitigating these at the design stage will be considered. Options for avoiding the areas of water vole presence will be considered first, followed by on-site mitigation, and finally offsite mitigation.
46. If mitigation is required in order to ensure there is no adverse impact on the water vole population identified due to the project, the Water Vole Mitigation Handbook (Dean *et al.*, 2016) should be used to inform any mitigation design and any licensing requirements for the project.

22.5.2 Further Surveys

47. For those watercourses surveyed as part of the Water Vole Survey, no further surveys are recommended at this stage (see section 22.3.2). Depending on the works planned within the survey area, pre-construction surveys (within the survey season prior to construction) may be required and if this is the case an ecologist will be consulted.
48. For those watercourses where landowner access was not granted during the Water Vole Survey, a Water Vole Survey will need to be undertaken prior to the commencement of construction in order to effectively characterise the baseline environment. This includes those watercourses which have not been visited during the Extended Phase 1 Habitat Survey (estimated to be a further 10 watercourses). The methodology for these surveys will follow the methodology set out in section 22.3.

22.6 Conclusions

49. A Water Vole Survey of 31 watercourses located within 50m of the project onshore infrastructure to which survey access has been granted was undertaken during May and June 2017.
50. Evidence of water vole presence was found in seven watercourses within the survey area. Of these, one watercourse (the River Wensum) contained a high relative population density, and six contained a low relative population density.
51. All further watercourses located within the survey area to which access permission has not yet been granted (estimated to be a further 12 watercourses in total) will require a Water Vole Survey prior to any construction activity for the project.

22.7 References

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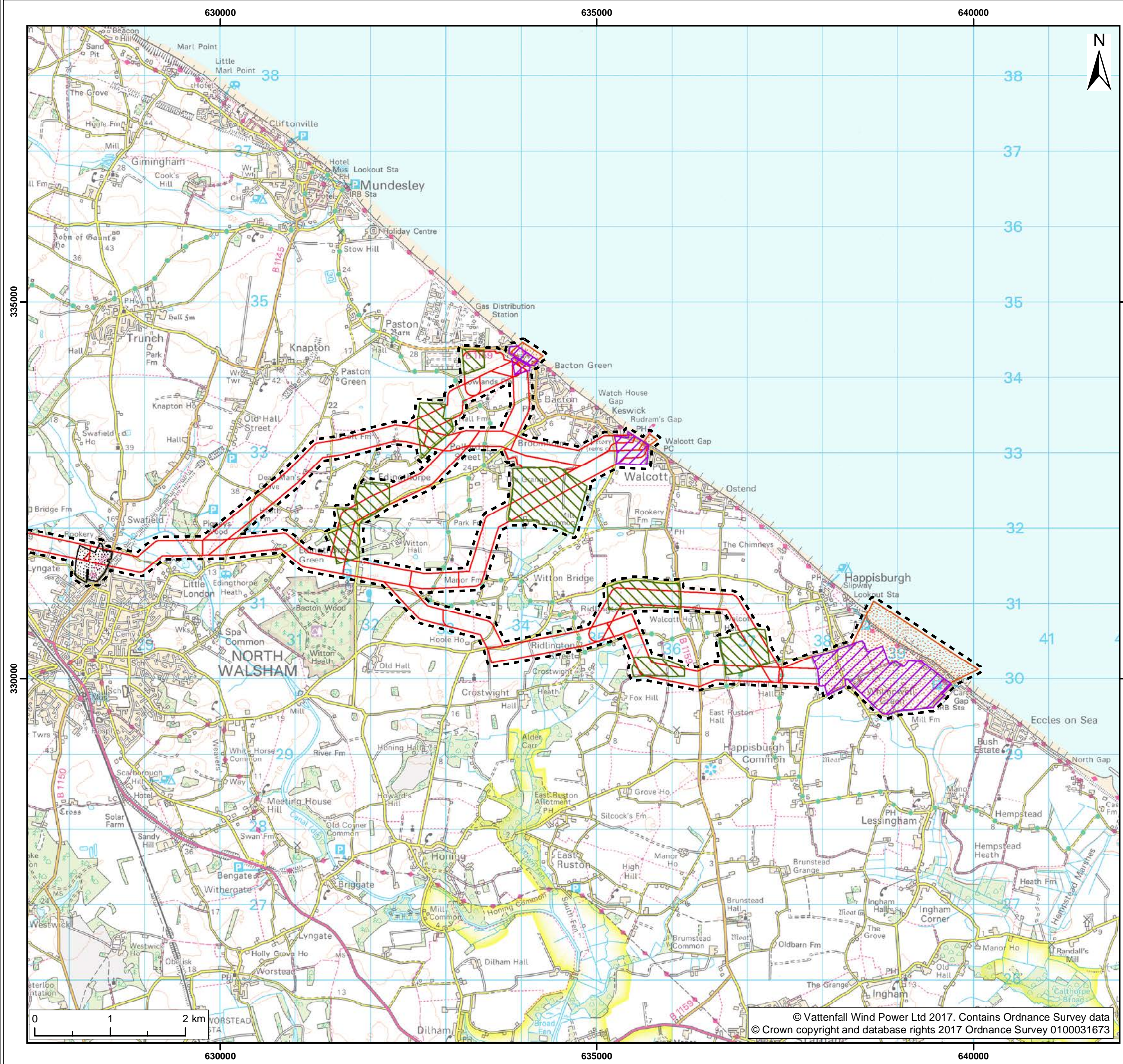
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Strachan, R., Moorhouse, T. and Gelling, M. (2011) Water Vole Conservation Handbook 3rd Edition. Wildlife Conservation Unit, University of Oxford.

22.8 Annex A: Figures



Legend:

- Survey Area
- Landfall Zone
- Cable Relay Station Search Zone
- Onshore Cable Corridor
- Horizontal Directional Drilling (HDD) Zone
- Mobilisation Zone

Norfolk Vanguard Onshore Infrastructure

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

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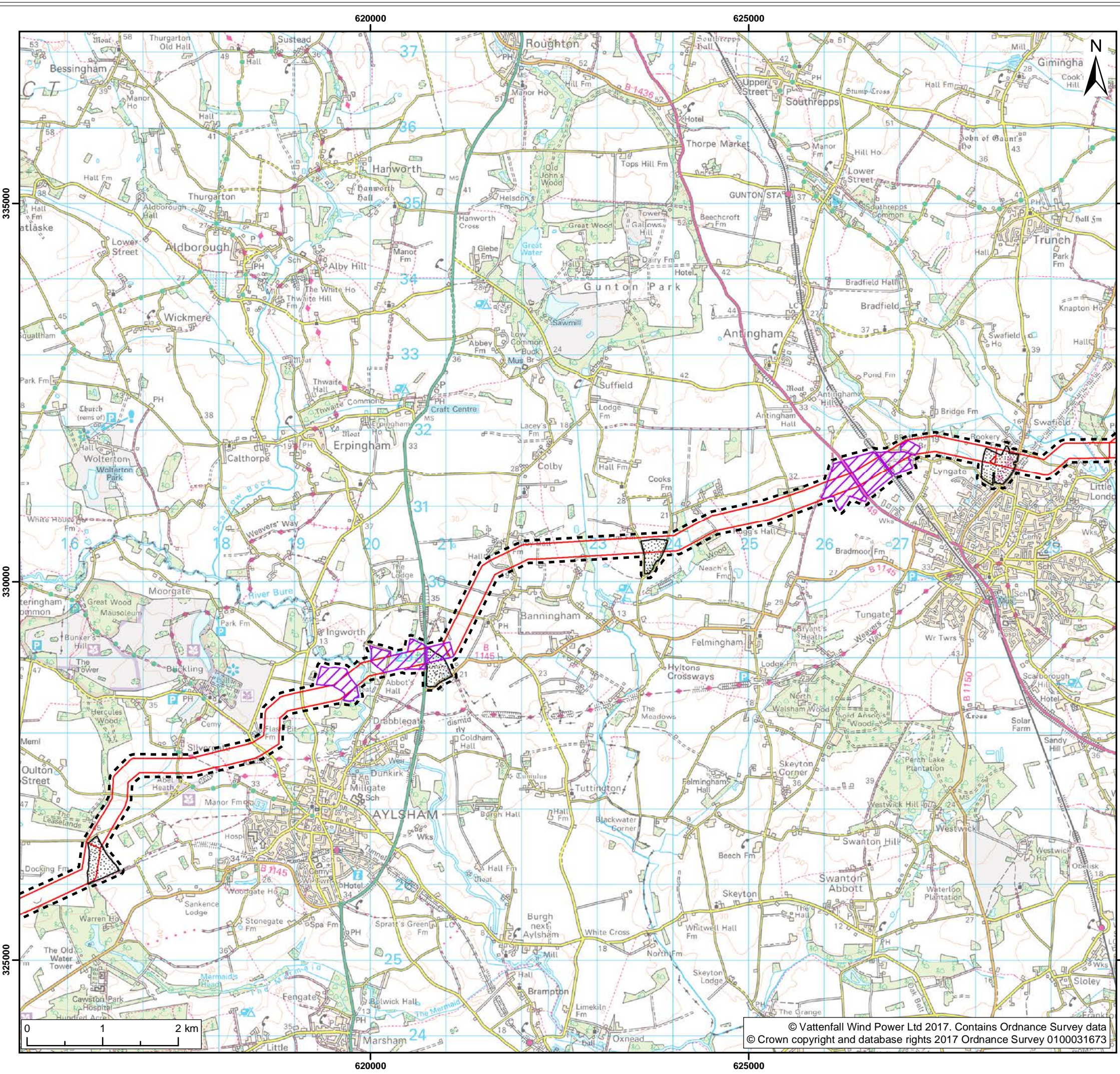
Survey Location
(Map 1 of 5)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Horizontal Directional Drilling (HDD) Zone
- Mobilisation Zone

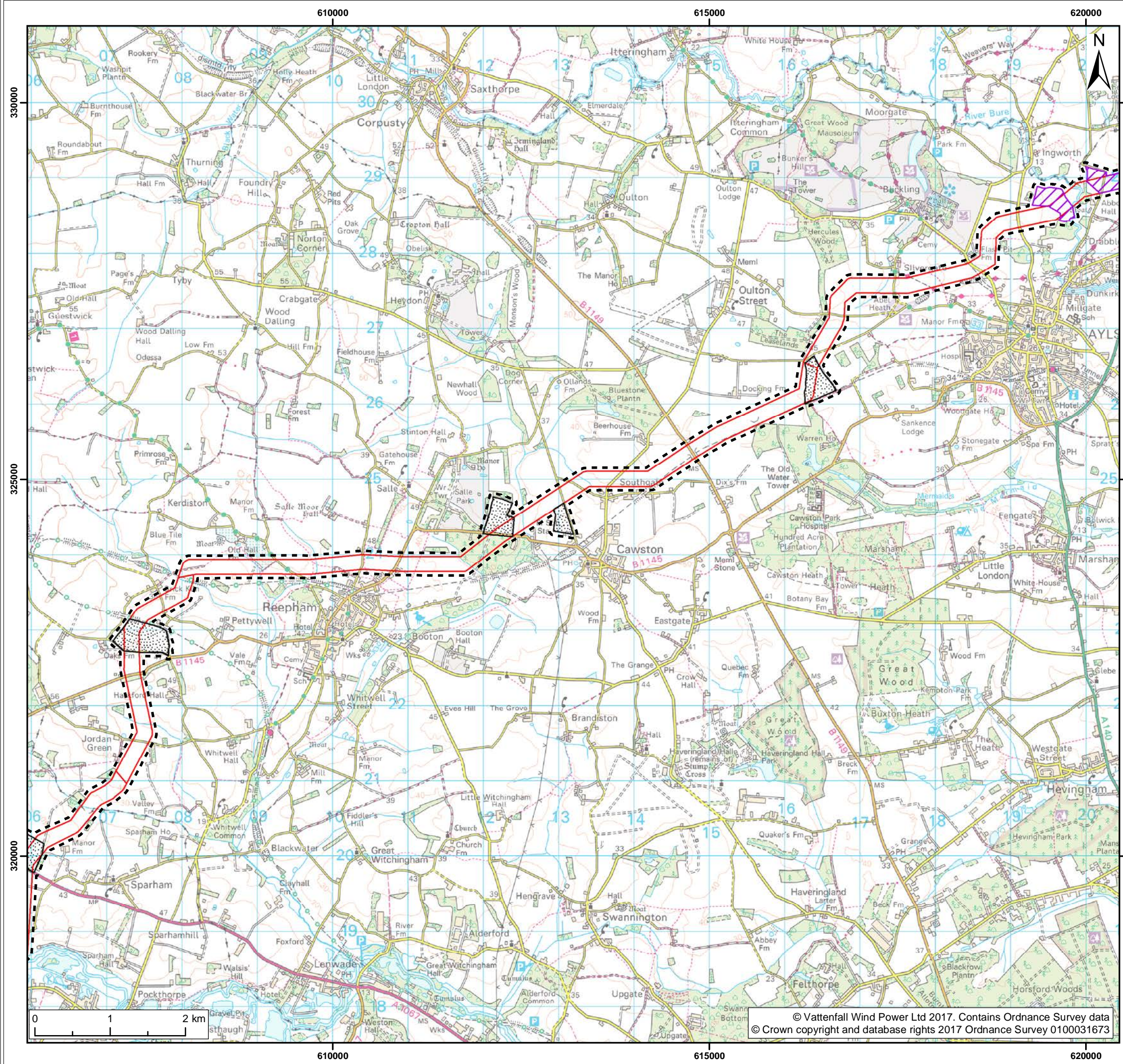
Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

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(Map 2 of 5)

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Co-ordinate system: British National Grid EPSG: 27700

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- Legend:
- Survey Area
 - Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Horizontal Directional Drilling (HDD) Zone
 - Mobilisation Zone

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

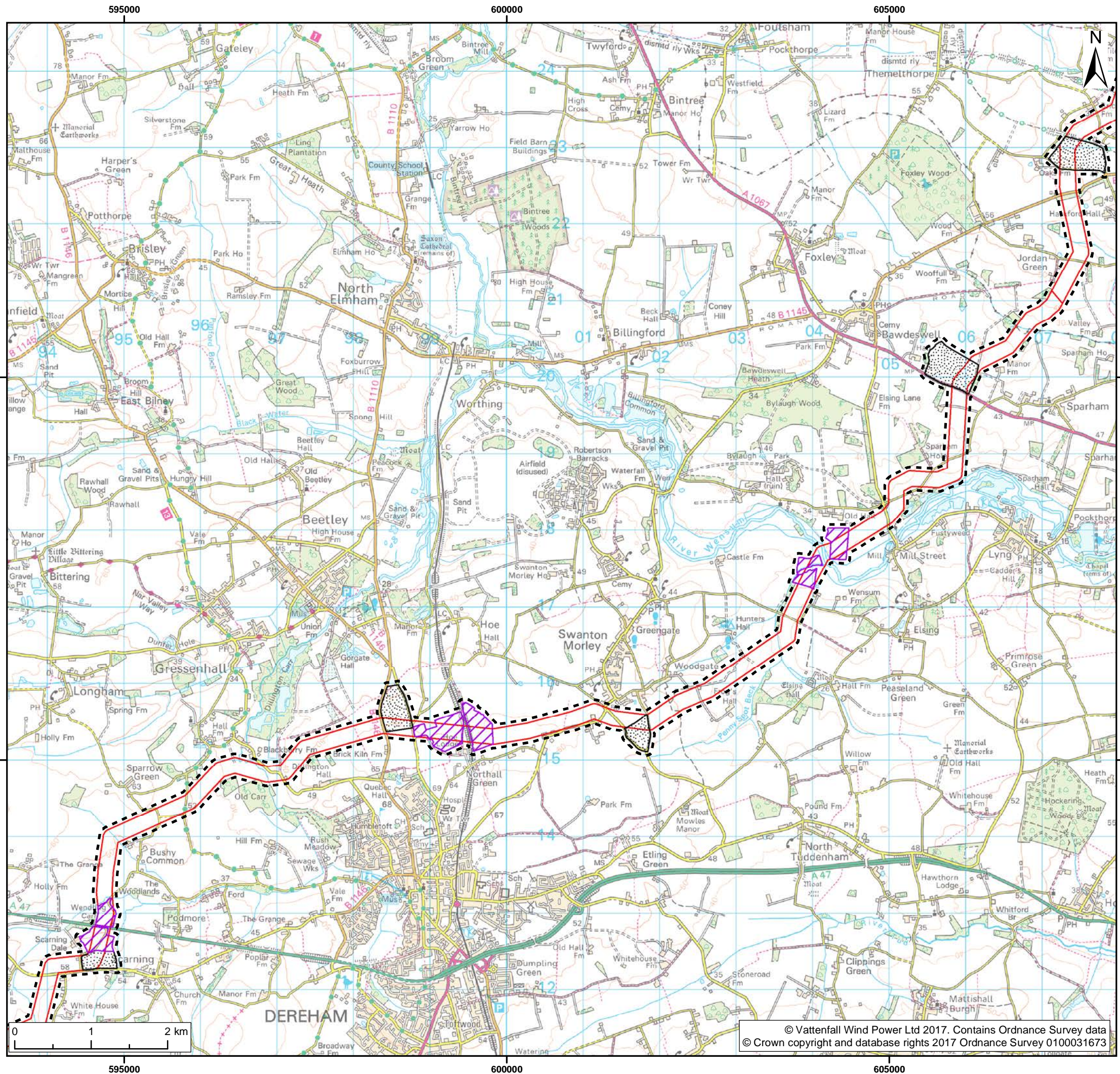
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Co-ordinate system: British National Grid EPSG: 27700





Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Horizontal Directional Drilling (HDD) Zone
- Mobilisation Zone

Project: Norfolk Vanguard	Report: Preliminary Environmental Information Report: Water Vole Survey Report
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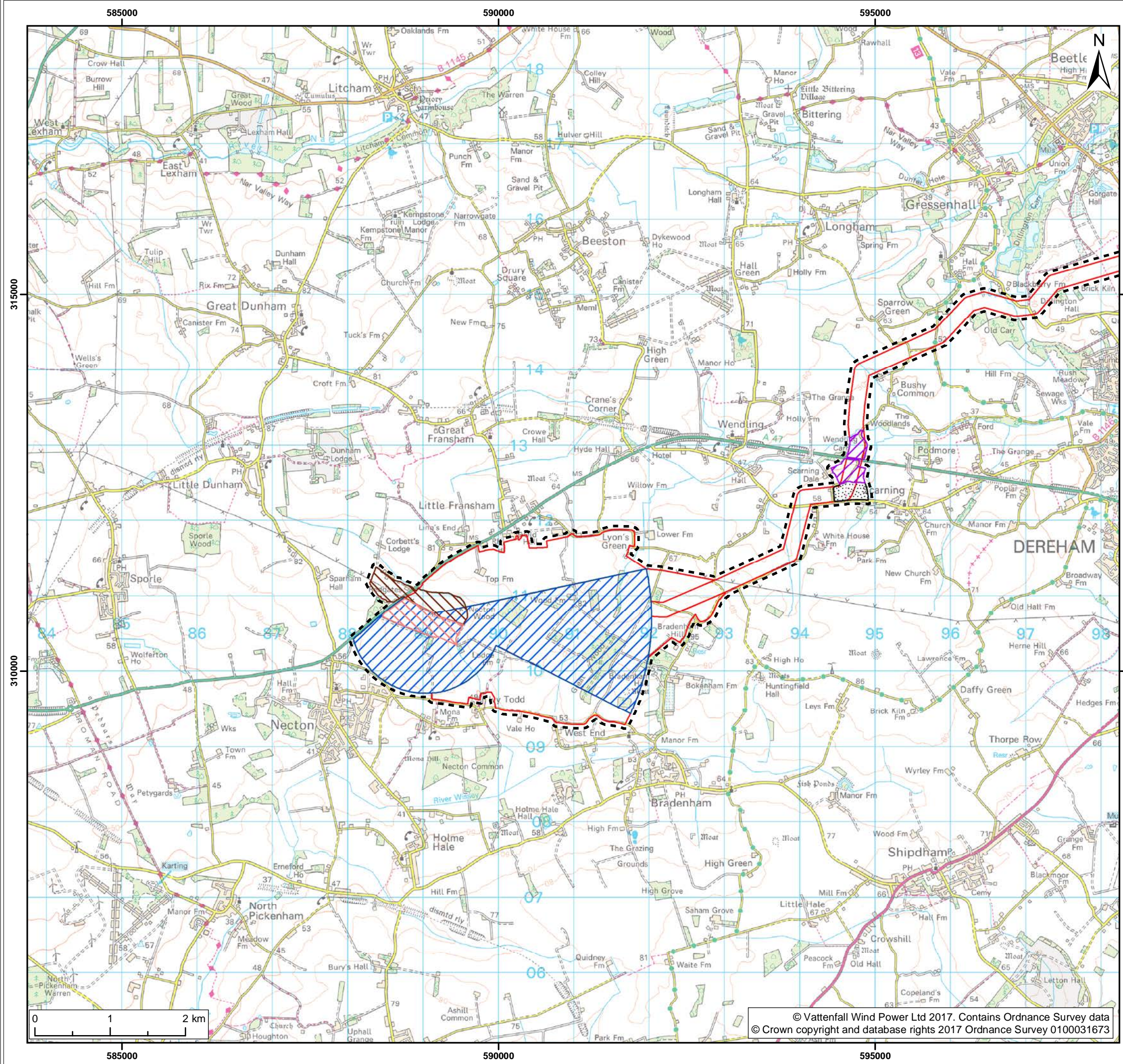
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Horizontal Directional Drilling (HDD) Zone
- Mobilisation Zone
- Project Substation Search Zone
- National Grid Substation Extension Zone
- Overhead Line Modification Zone

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:	Survey Location (Map 5 of 5)
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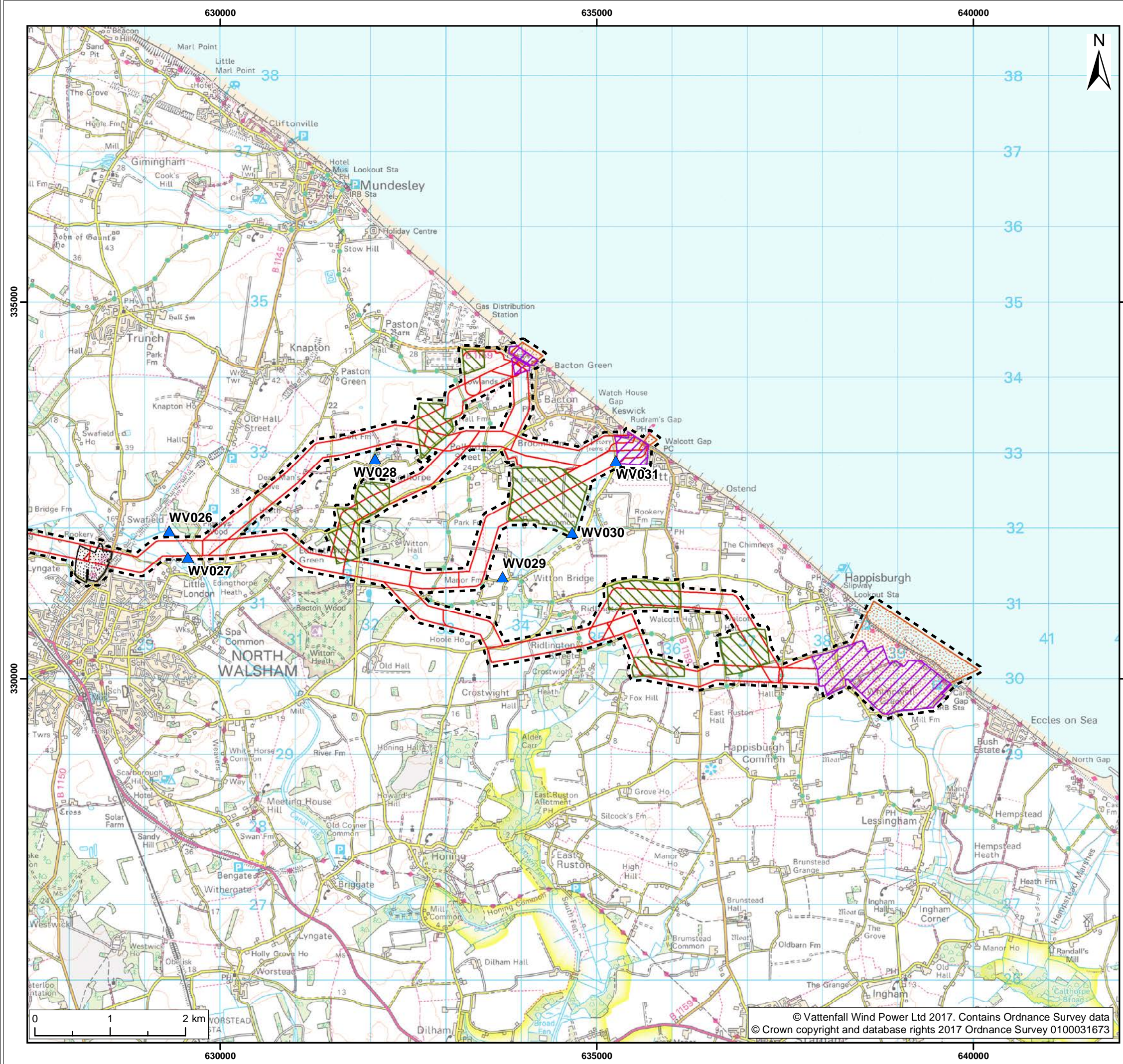
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Co-ordinate system: British National Grid EPSG: 27700

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- Legend:
- Survey Area
 - Norfolk Vanguard Onshore Infrastructure**
 - Landfall Zone
 - Cable Relay Station Search Zone
 - Onshore Cable Corridor
 - Horizontal Directional Drilling (HDD) Zone
 - Mobilisation Zone
 - Water Vole Survey Location

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

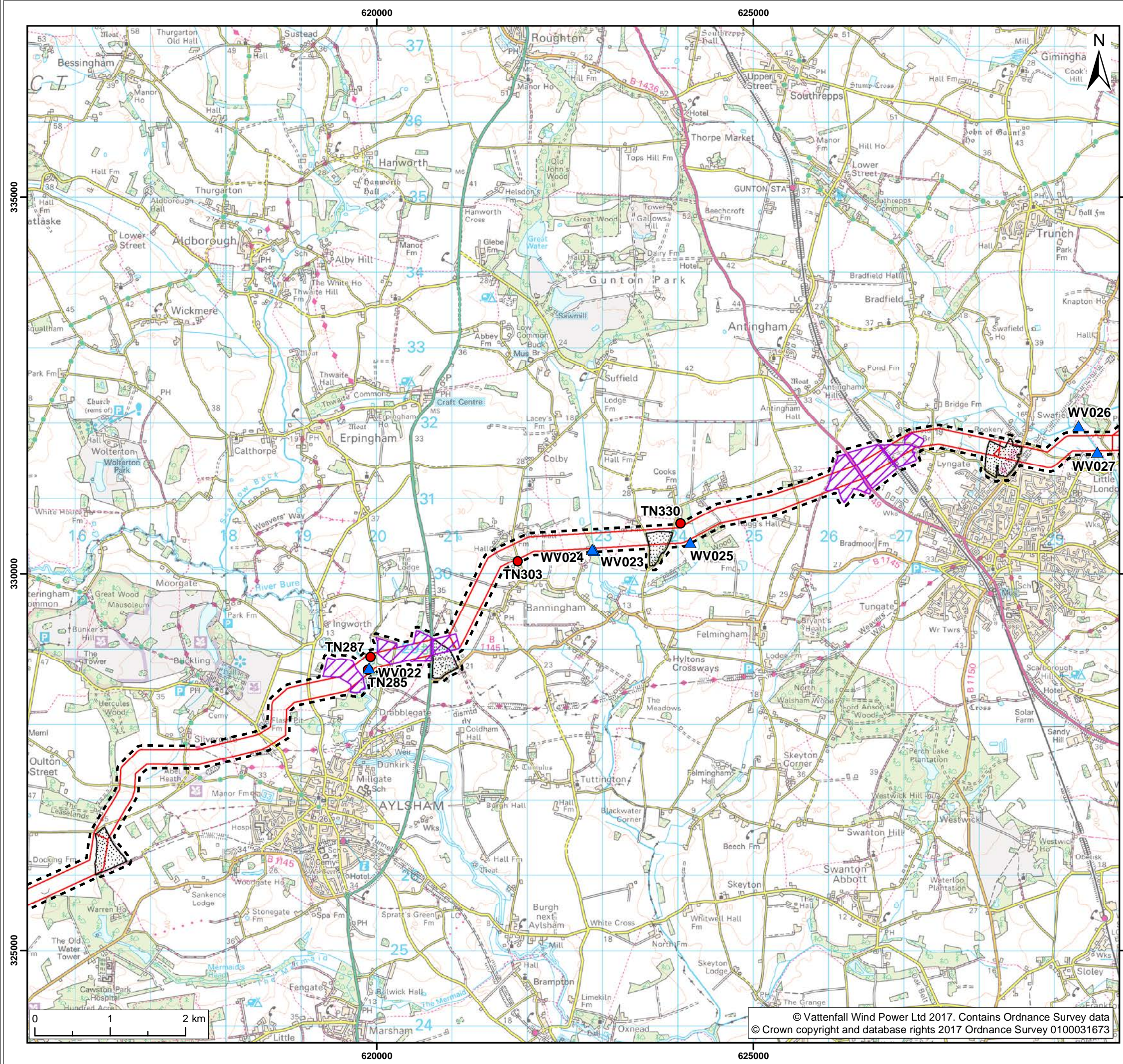
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Water Bodies Screened into Further Survey (Map 1 of 5)

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Co-ordinate system: British National Grid EPSG: 27700



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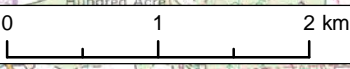
- Legend:
- Survey Area
 - Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Horizontal Directional Drilling (HDD) Zone
 - Mobilisation Zone
 - Water Vole Survey Location
 - Sub-optimal for Water vole, (no presence/absence surveys undertaken)

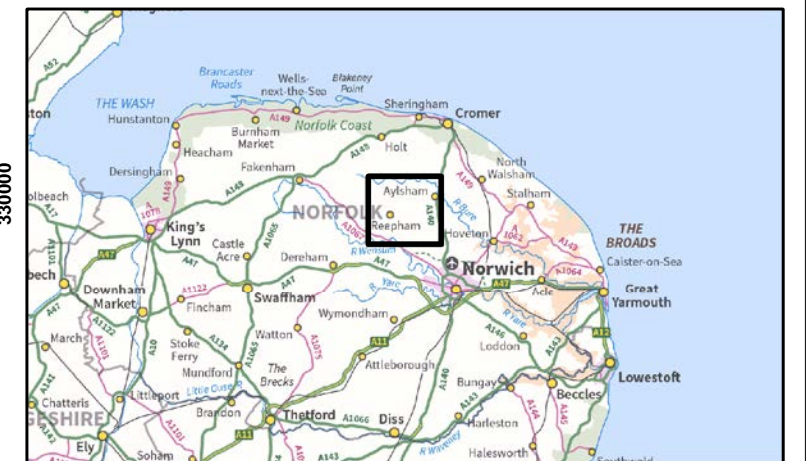
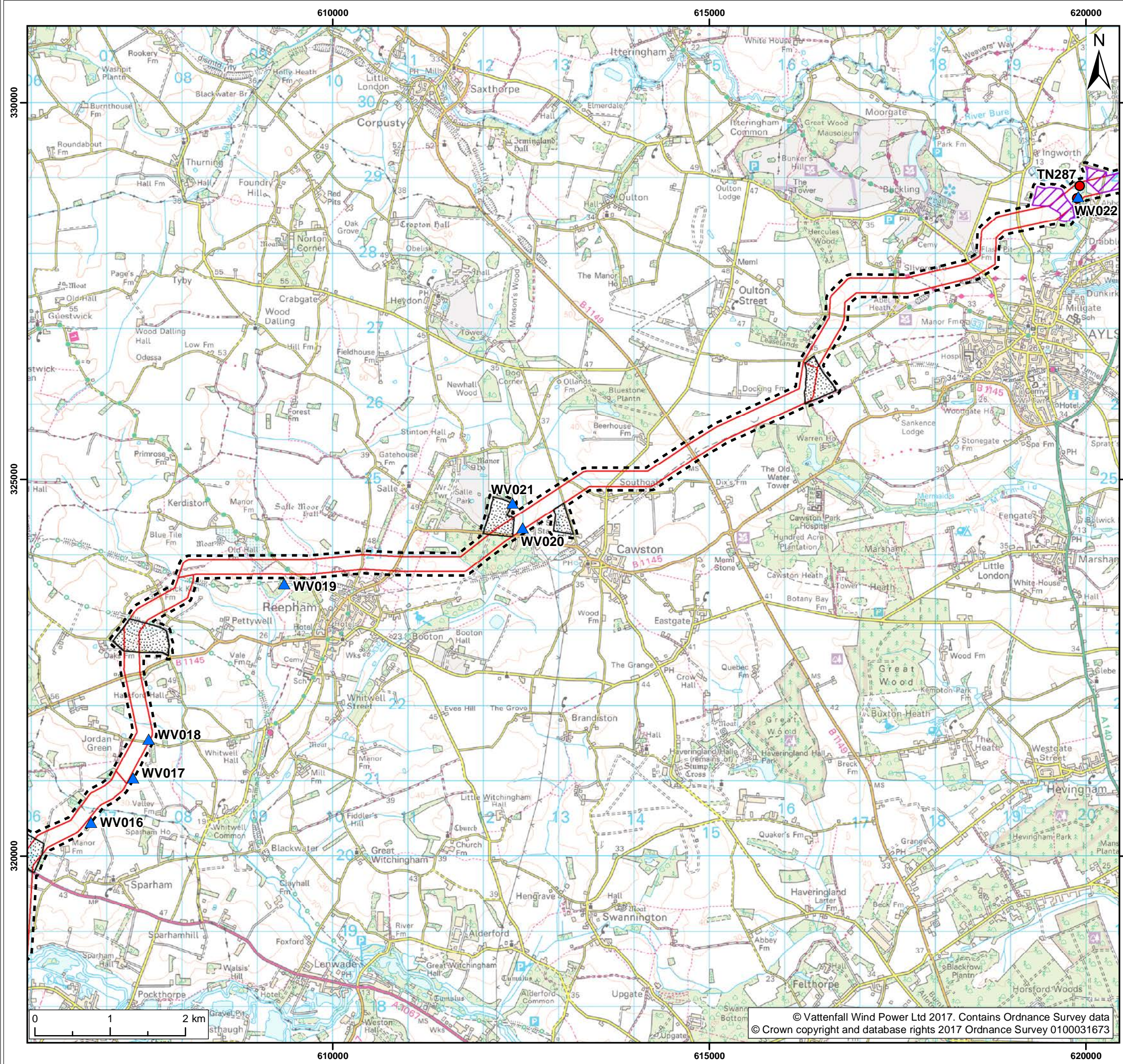
Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:
Water Bodies Screened into Further Survey
(Map 2 of 5)

Figure:	2	Drawing No:	PB4476-004-0223-002			
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02	30/08/2017	LB	GC	A3	1:50,000	

Co-ordinate system: British National Grid EPSG: 27700





- Legend:
- Survey Area
 - Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Horizontal Directional Drilling (HDD) Zone
 - Mobilisation Zone
 - Water Vole Survey Location
 - Sub-optimal for Water vole, (no presence/absence surveys undertaken)

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

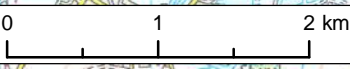
Title:
Water Bodies Screened into Further Survey (Map 3 of 5)

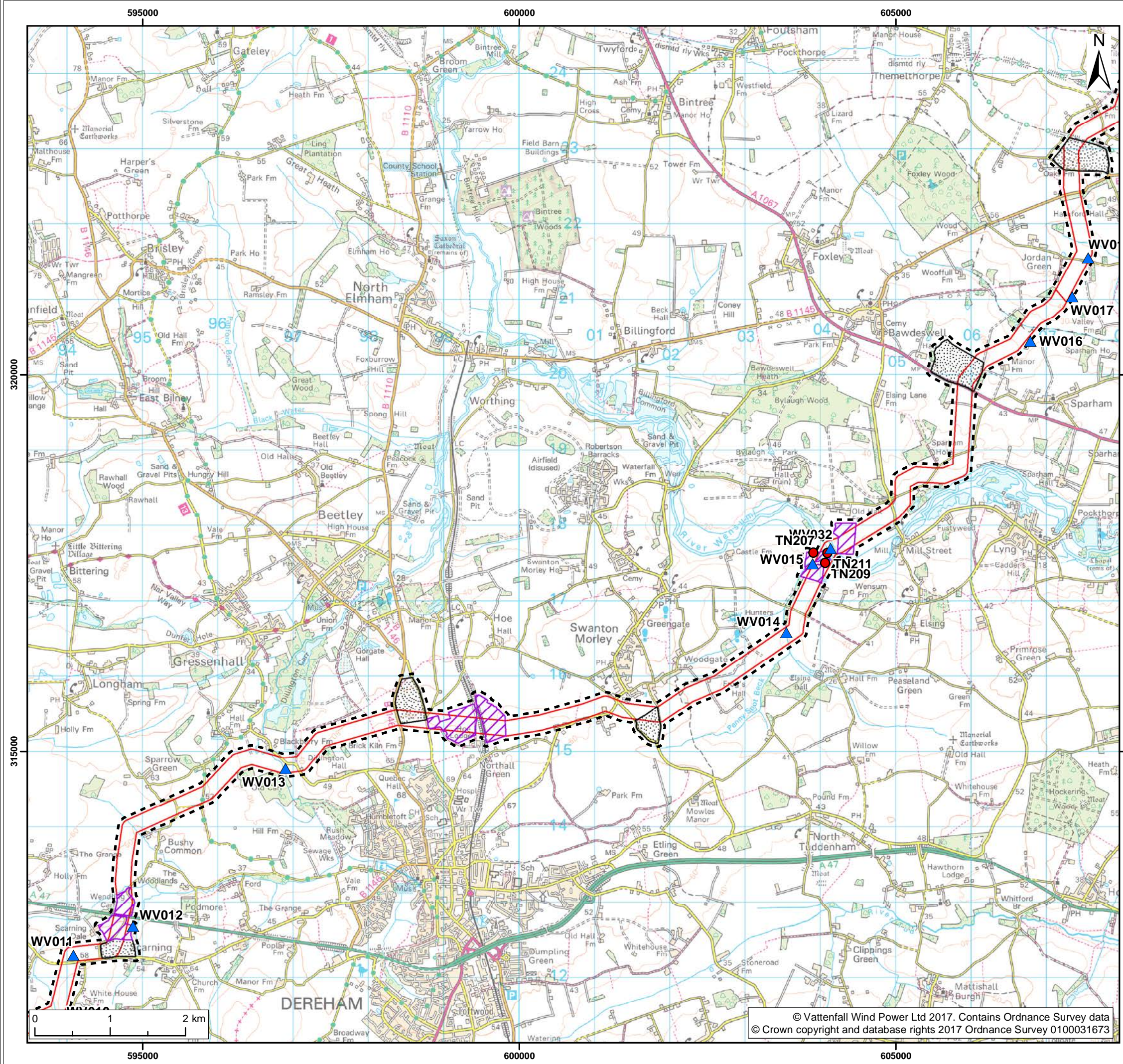
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Co-ordinate system: British National Grid EPSG: 27700



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- Legend:
- Survey Area
 - Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Horizontal Directional Drilling (HDD) Zone
 - Mobilisation Zone
 - Water Vole Survey Location
 - Sub-optimal for Water vole, (no presence/absence surveys undertaken)

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:

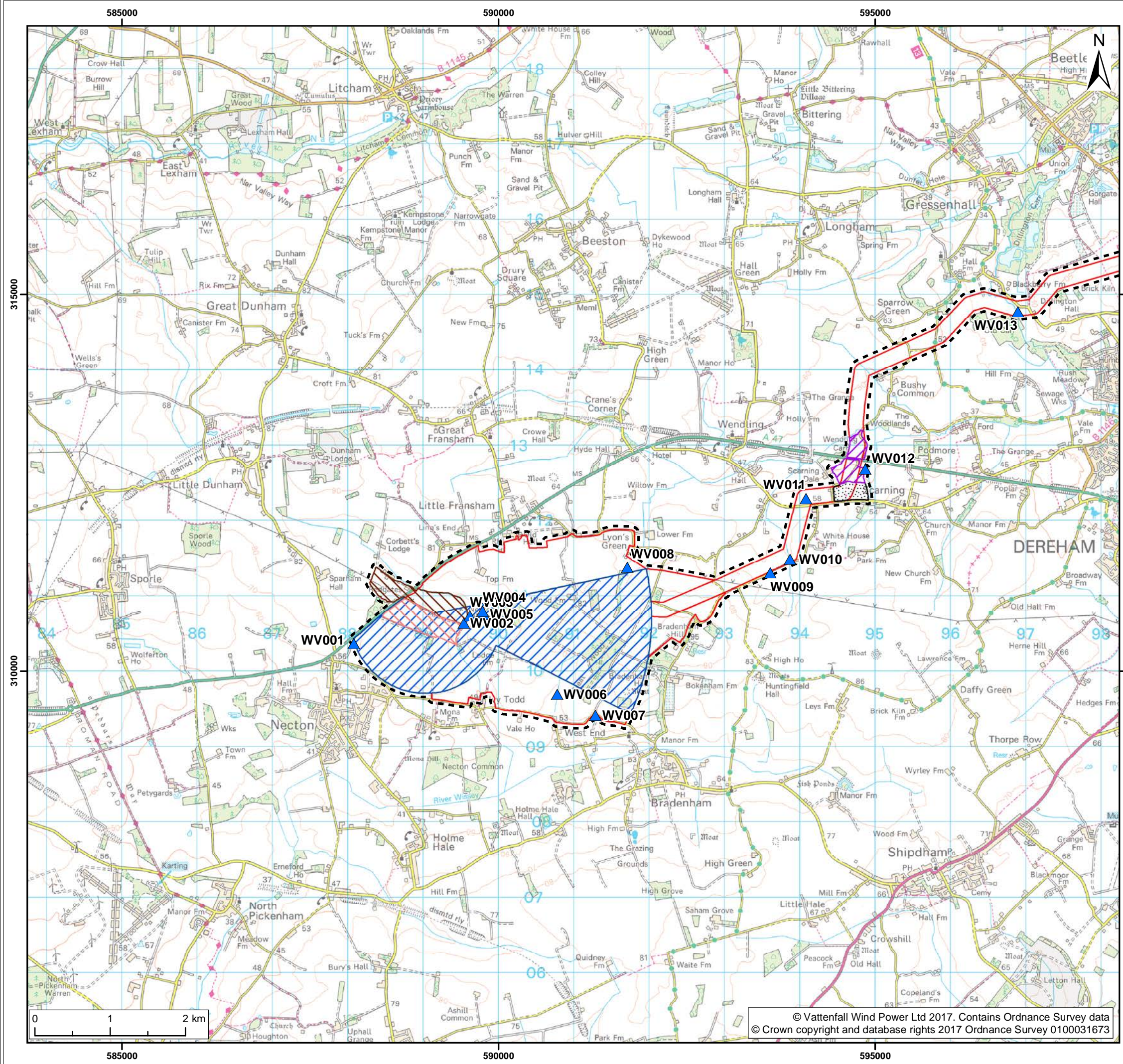
Water Bodies Screened into Further Survey
(Map 4 of 5)

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Co-ordinate system: British National Grid EPSG: 27700



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- Legend:
- Survey Area
 - Onshore Cable Corridor
 - Horizontal Directional Drilling (HDD) Zone
 - Mobilisation Zone
 - Project Substation Search Zone
 - National Grid Substation Extension Zone
 - Overhead Line Modification Zone
 - Water Vole Survey Location

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

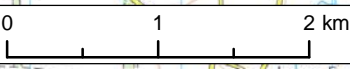
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(Map 5 of 5)

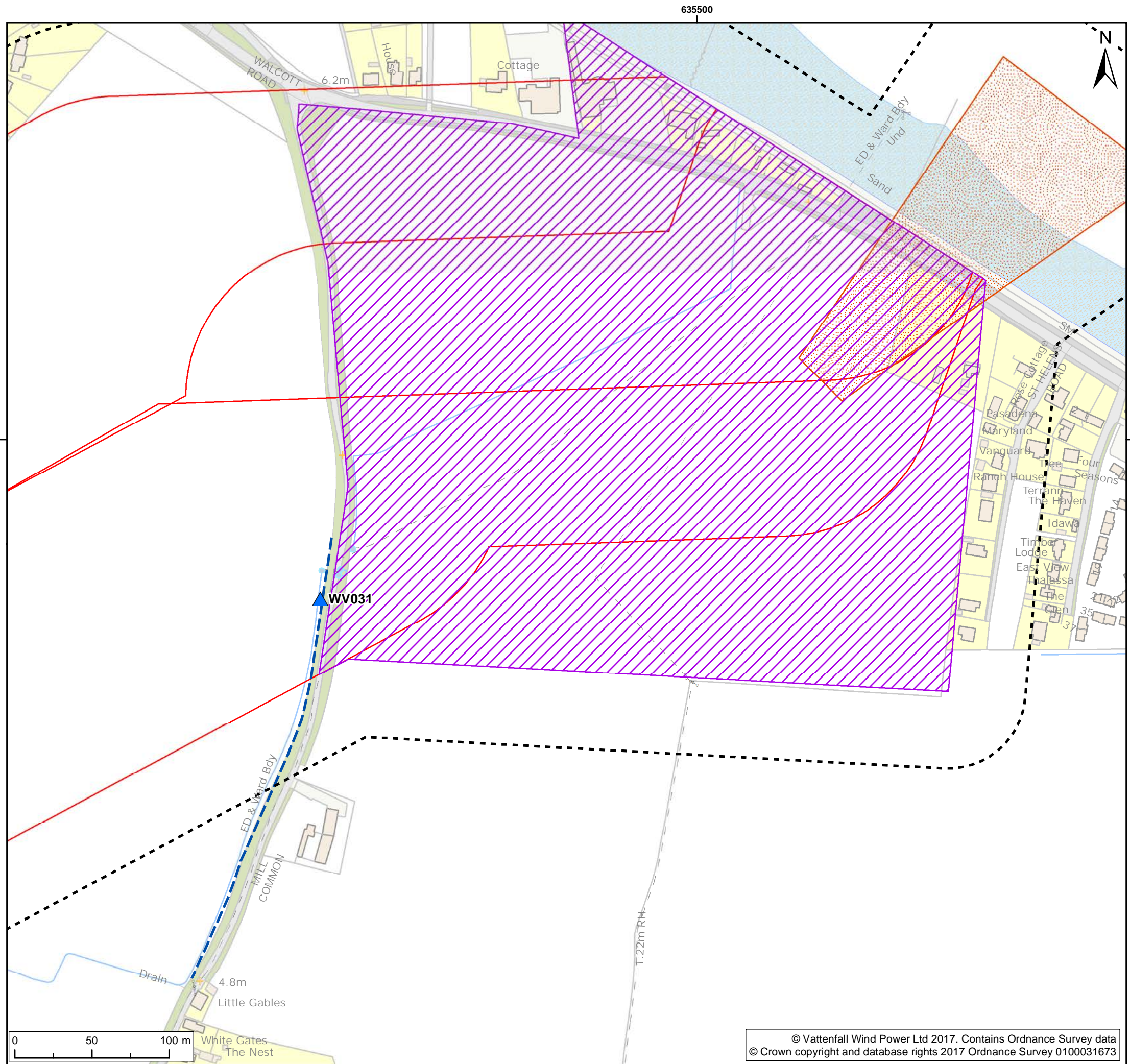
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Co-ordinate system: British National Grid EPSG: 27700



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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Landfall Zone
- Onshore Cable Corridor
- Horizontal Directional Drilling (HDD) Zone
- Water vole Survey Extent
- Water vole Survey Location

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

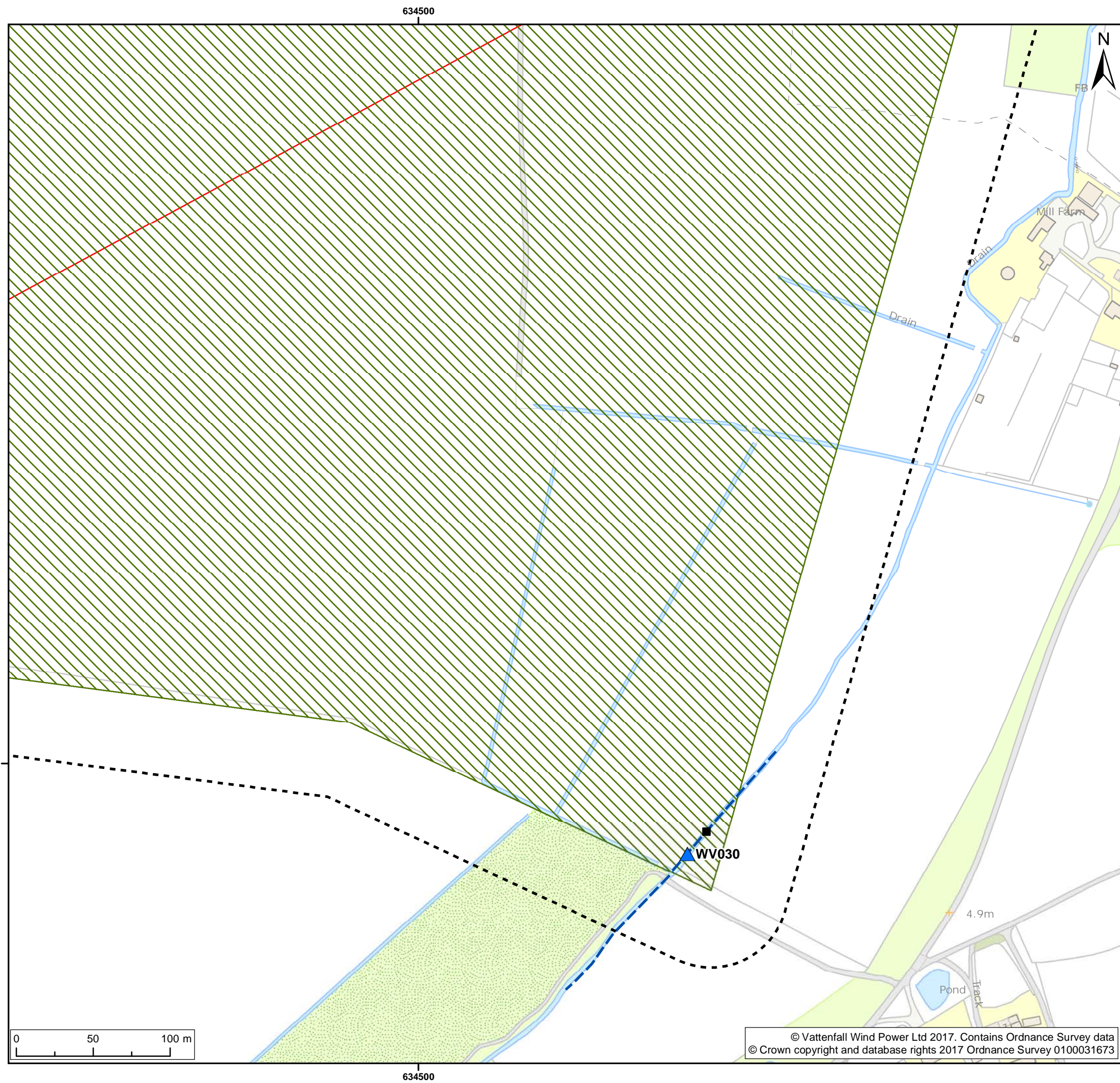
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Water Vole Survey Results
(Page 1 of 21)

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Co-ordinate system: British National Grid EPSG: 27700



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Legend:

- Survey Area
- Cable Relay Station Search Zone
- Onshore Cable Corridor
- Water vole Survey Extent
- Water vole Survey Location
- Other Points of Interest

Norfolk Vanguard Onshore Infrastructure

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

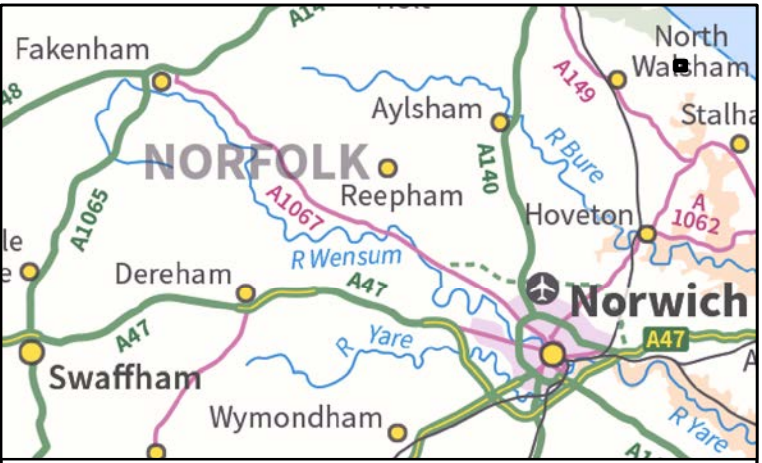
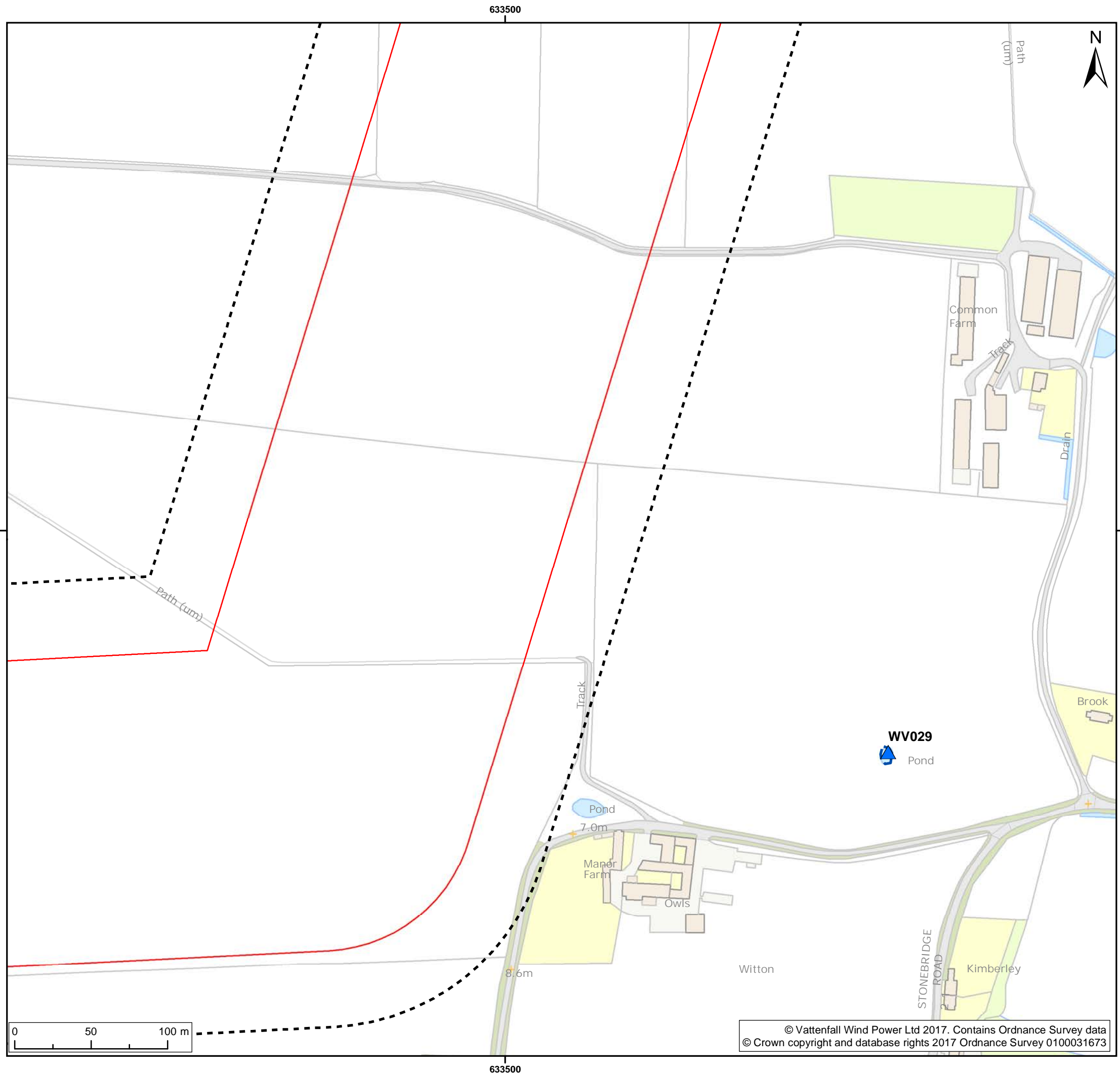
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(Page 2 of 21)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Water vole Survey Extent
- Water vole Survey Location

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:
Water Vole Survey Results
(Page 3 of 21)

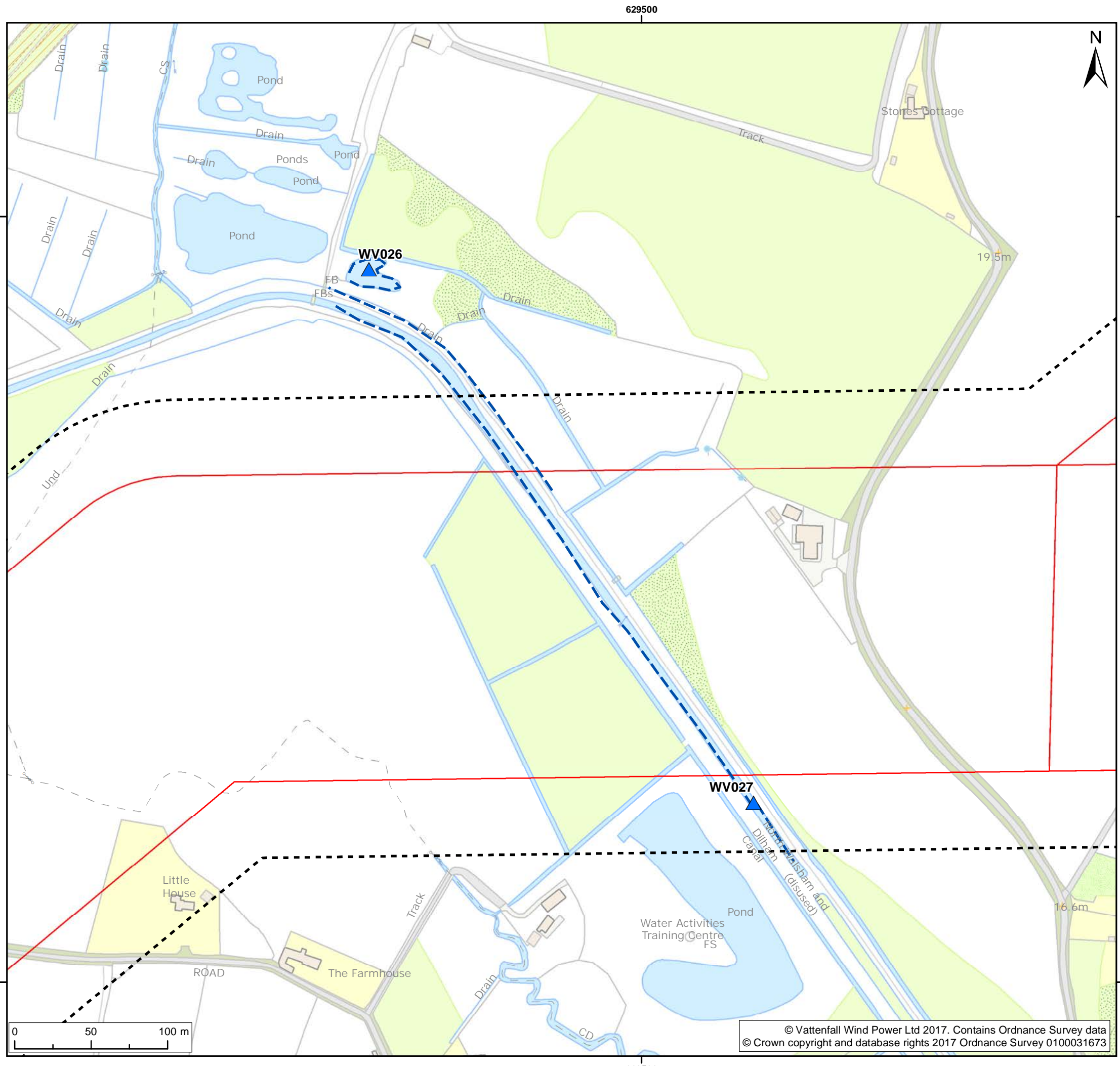
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Water vole Survey Extent
- Water vole Survey Location

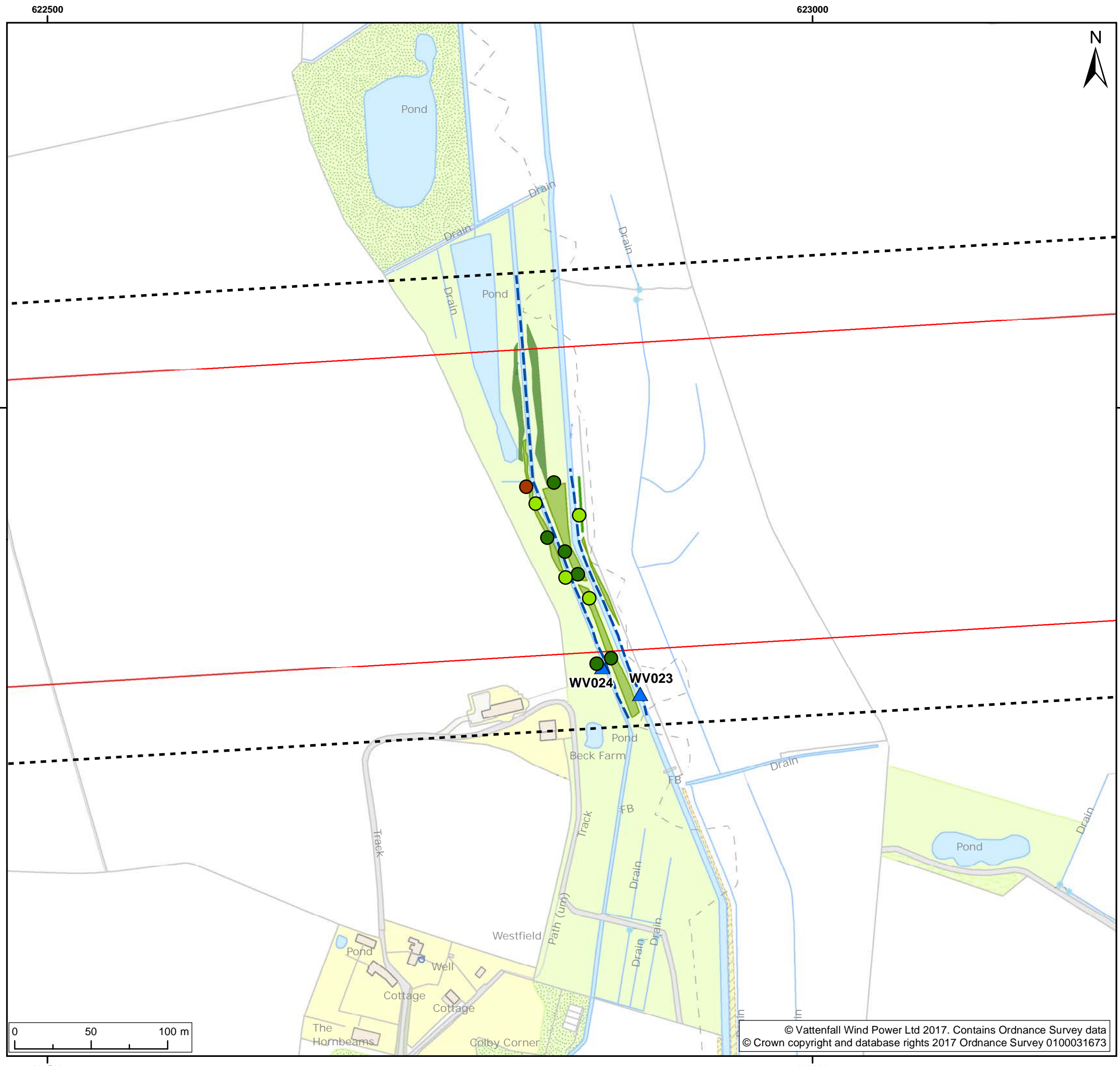
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Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:
Water Vole Survey Results
(Page 5 of 21)

Figure:	3	Drawing No:	PB4476-004-0223-003			
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01	25/07/2017	LB	GC	A3	1:2,500	

Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure
- Water vole Survey Extent
- ▲ Water vole Survey Location

Bankside Vegetation

- Scrub Area
- Hedgerow
- Exposed Roots
- Fallen Tree
- Mature Tree

Adjacent Land Use

- Broadleaved Woodland

Project: Norfolk Vanguard	Report: Preliminary Environmental Information Report: Water Vole Survey Report
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Title:
Water Vole Survey Results
(Page 6 of 21)

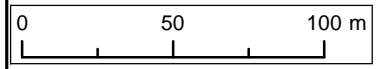
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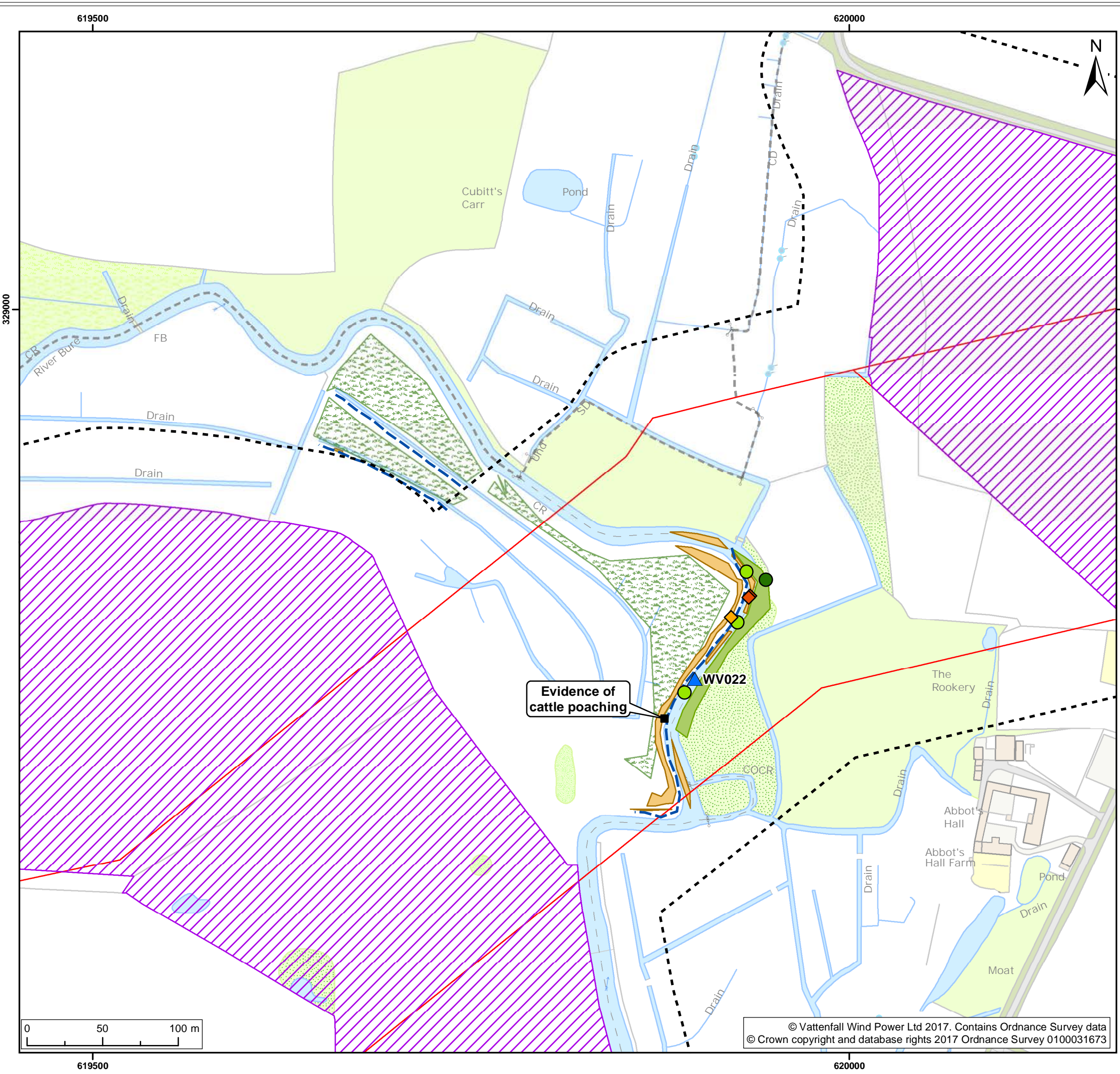
Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Horizontal Directional Drilling (HDD) Zone
 - Water vole Survey Extent
 - Water vole Survey Location
- Water vole Field Signs**
 - Burrows
 - Runs
- Bankside Vegetation**
 - Reedbeds
 - Scrub Area
 - Exposed Roots
 - Mature Tree
- Adjacent Land Use**
 - Improved Grassland
 - Other Points of Interest

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

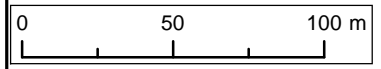
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(Page 7 of 21)

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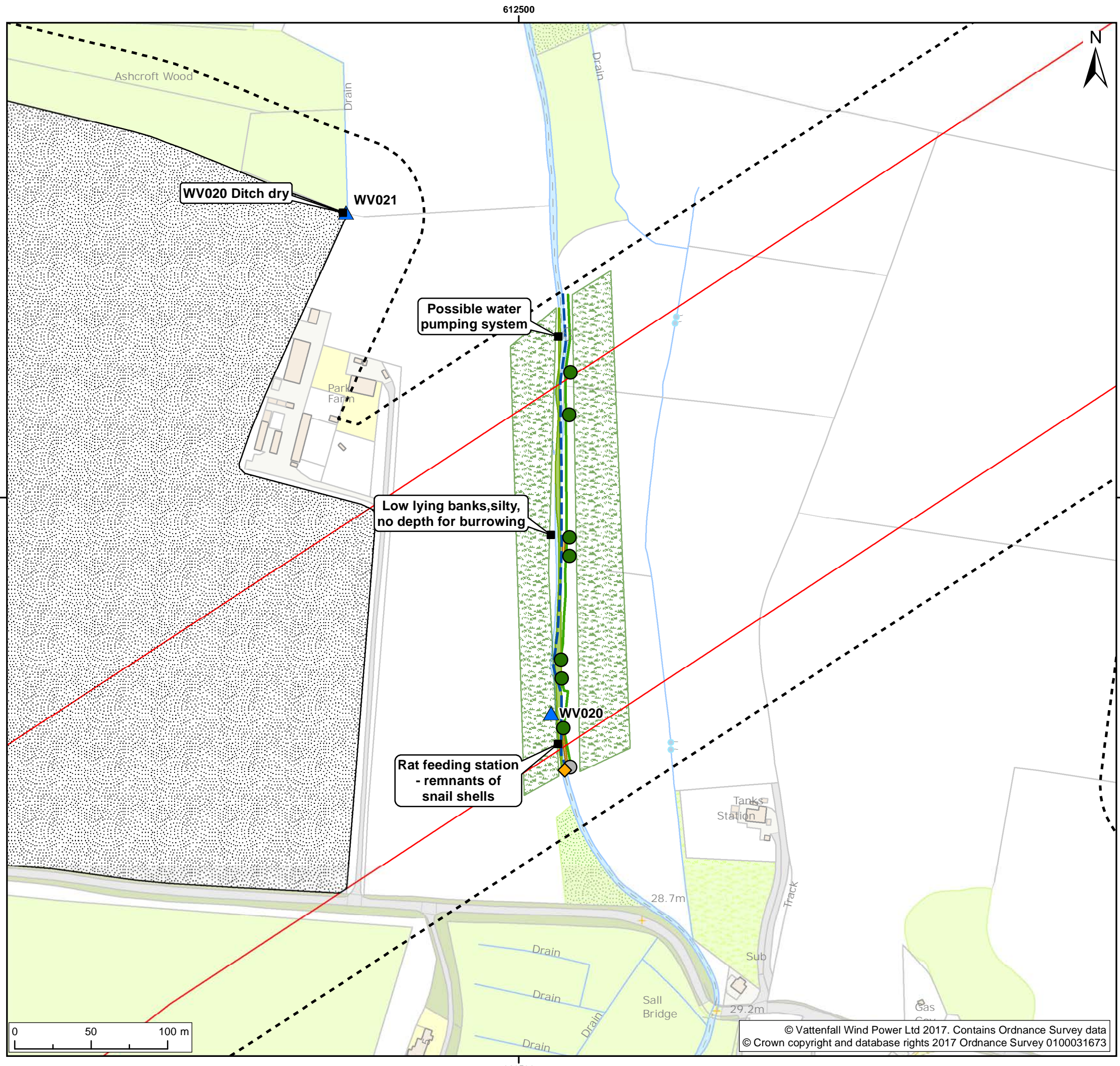
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Legend:

- Survey Area
- Onshore Cable Corridor
- Mobilisation Zone
- Water vole Survey Extent
- Water vole Survey Location
- Water vole Field Signs**
 - Burrows
- Bankside Vegetation**
 - Reedbeds
 - Scrub Area
 - Hedgerow
 - Mature Tree
 - Other
- Adjacent Land Use**
 - Improved Grassland
 - Other Points of Interest

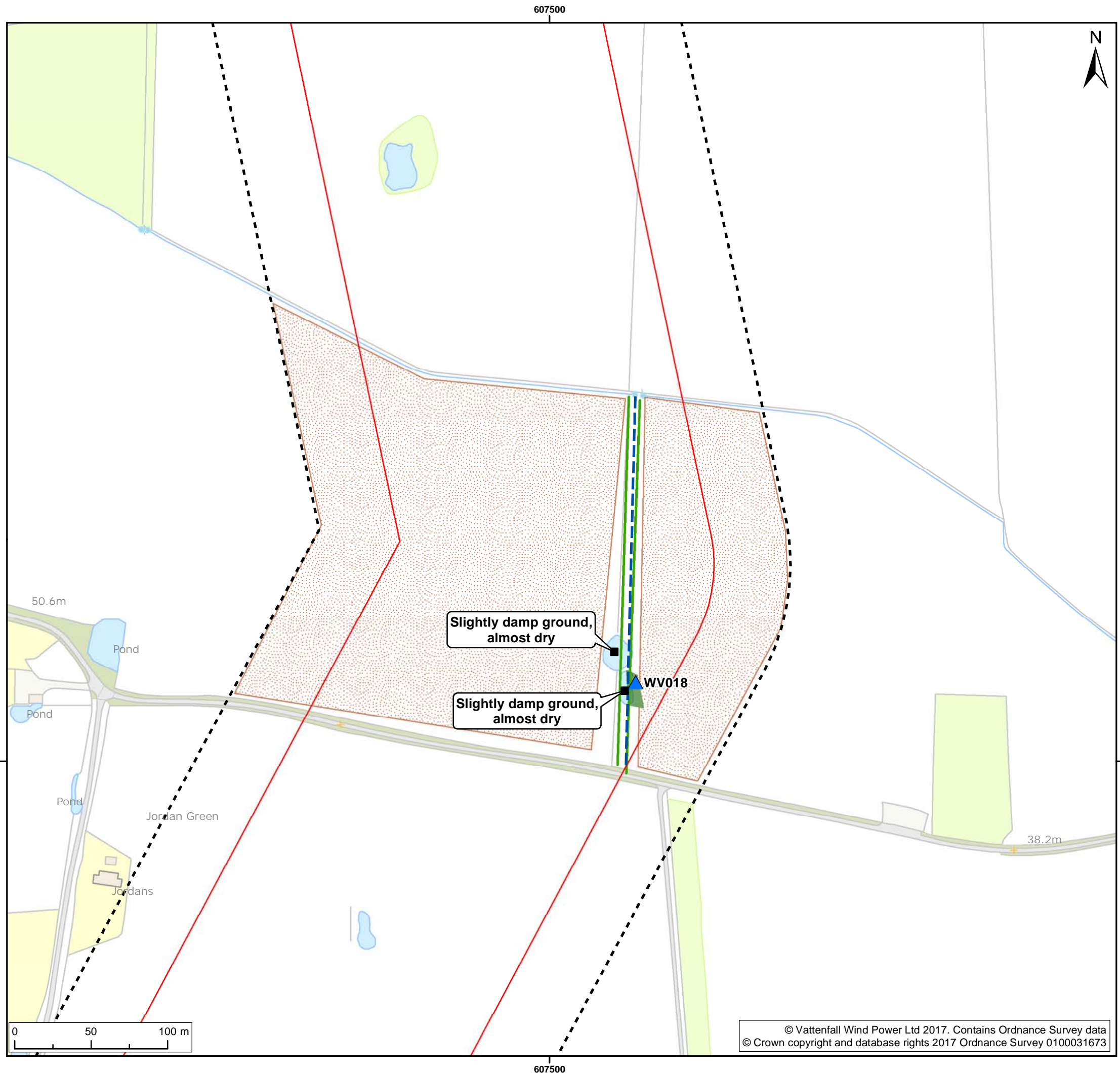
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Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:
Water Vole Survey Results
(Page 8 of 21)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Water vole Survey Extent
 - Water vole Survey Location
 - Hedgerow
- Adjacent Land Use**
 - Broadleaved Woodland
 - Tilled Land Crop
 - Other Points of Interest

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:

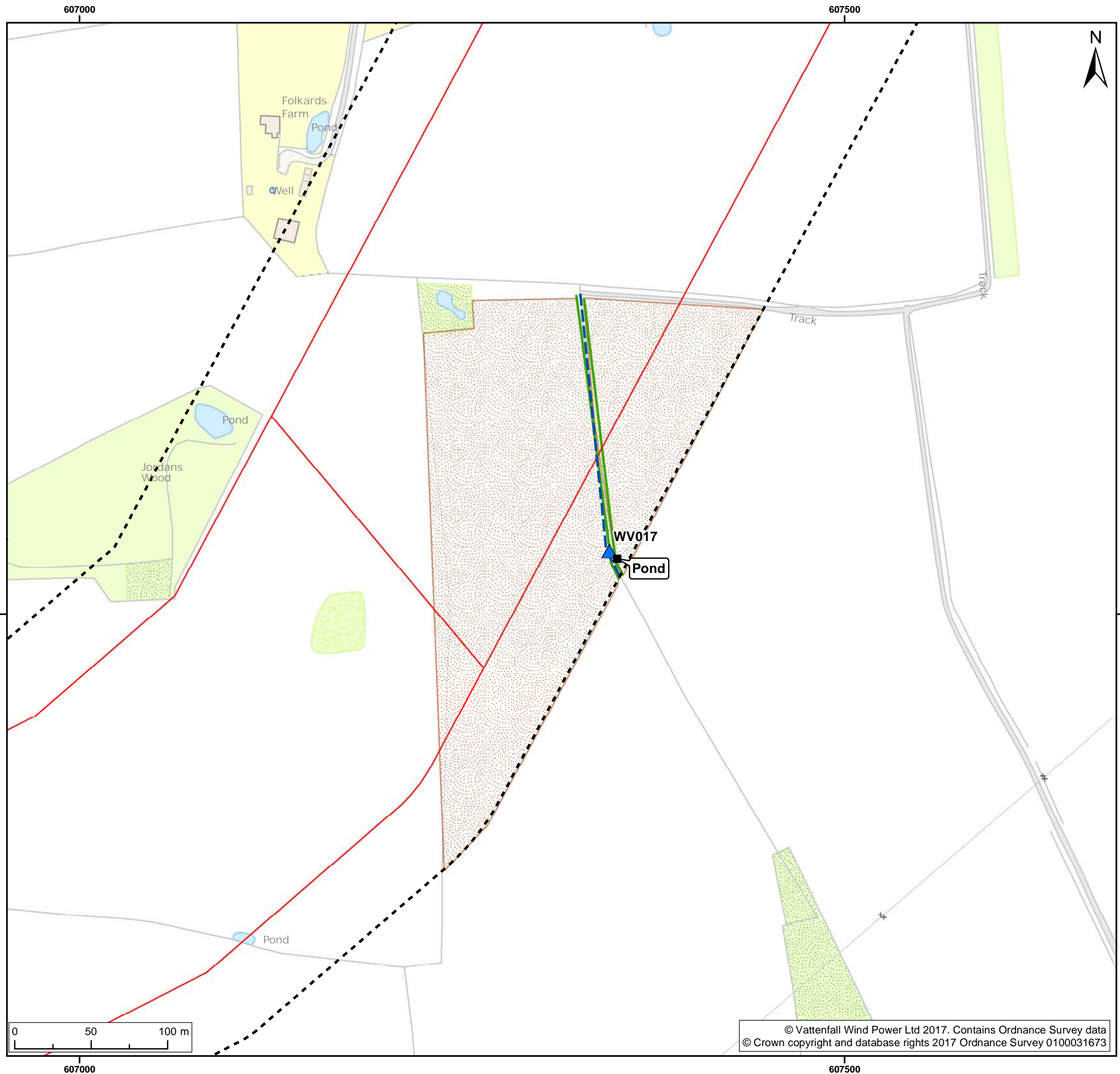
Water Vole Survey Results
(Page 9 of 21)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Water vole Survey Extent
- Water vole Survey Location
- Hedgerow
- Adjacent Land Use**
- Tilled Land Crop
- Other Points of Interest

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

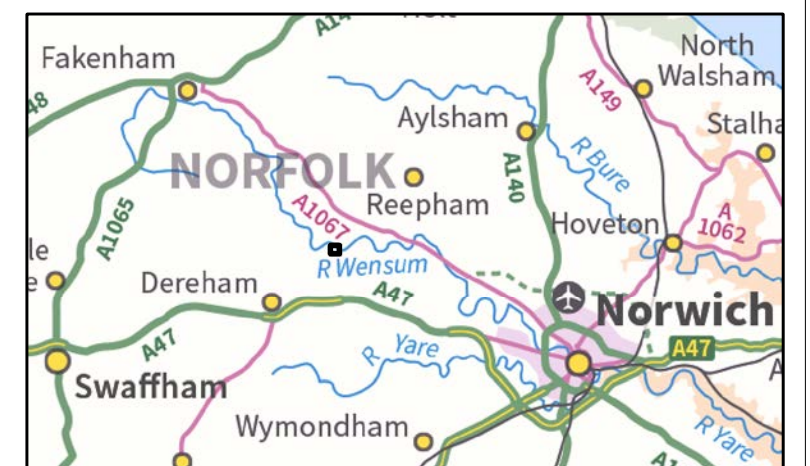
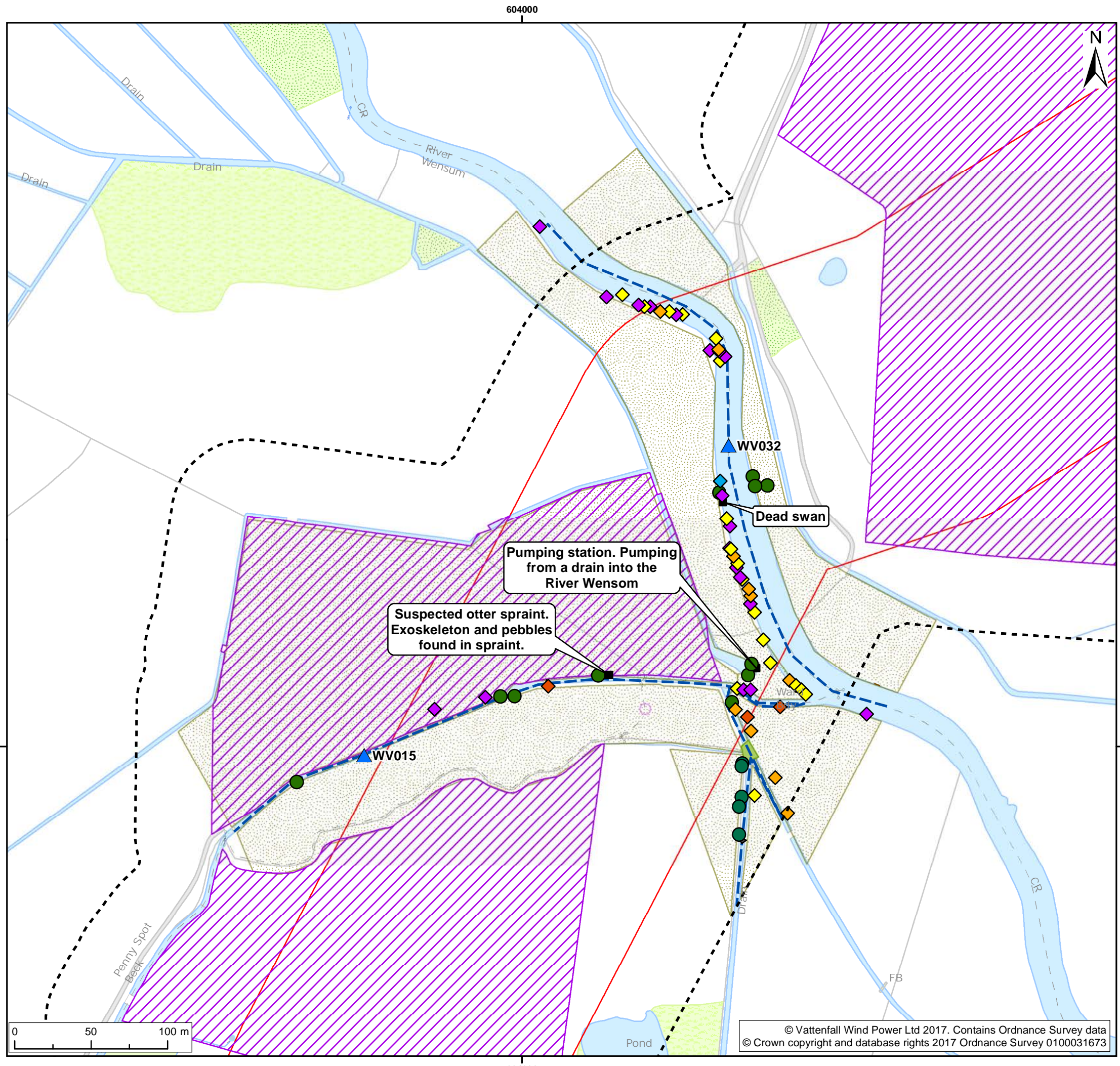
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Water Vole Survey Results
(Page 10 of 21)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Horizontal Directional Drilling (HDD) Zone
 - Water vole Survey Extent
 - Water vole Survey Location
- Water vole Field Signs**
 - Burrows
 - Feeding Station
 - Footprints
 - Latrine Site
 - Runs
- Bankside Vegetation**
 - Scrub Area
 - Mature Tree
 - Pollarded Tree
- Adjacent Land Use**
 - Rough Pasture
- Location of Other Features**
 - Footbridge
 - Artificial Bank
 - Norfolk Vanguard
 - Other Points of Interest

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:

Water Vole Survey Results
(Page 11 of 21)

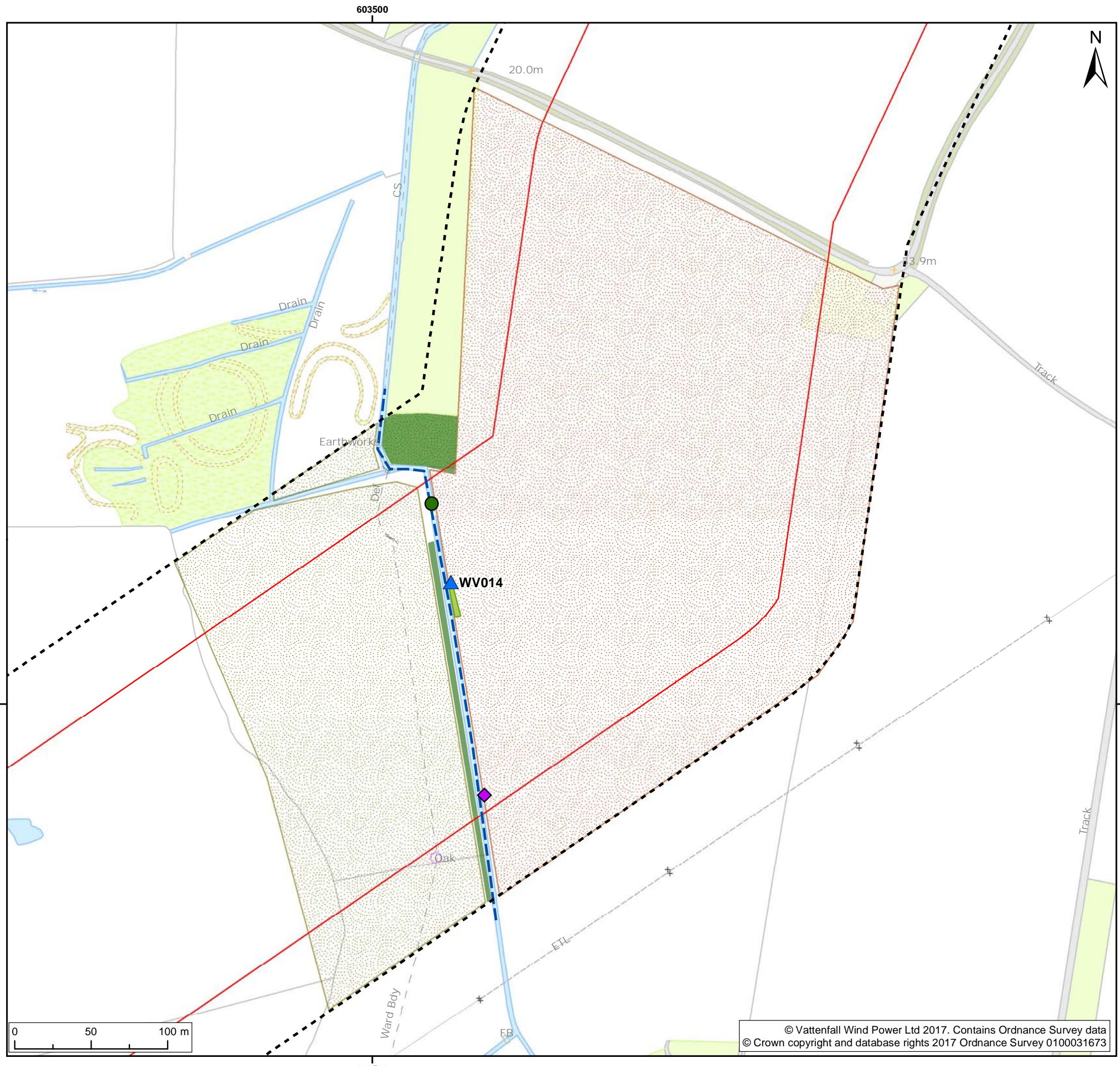
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Water vole Survey Extent
- ▲ Water vole Survey Location
- Water vole Field Signs**
- ◆ Feeding Station
- Bankside Vegetation**
- Scrub Area
- Mature Tree
- Adjacent Land Use**
- Broadleaved Woodland
- Rough Pasture
- Tilled Land Crop

Project: Norfolk Vanguard	Report: Preliminary Environmental Information Report: Water Vole Survey Report
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Title:
Water Vole Survey Results
(Page 12 of 21)

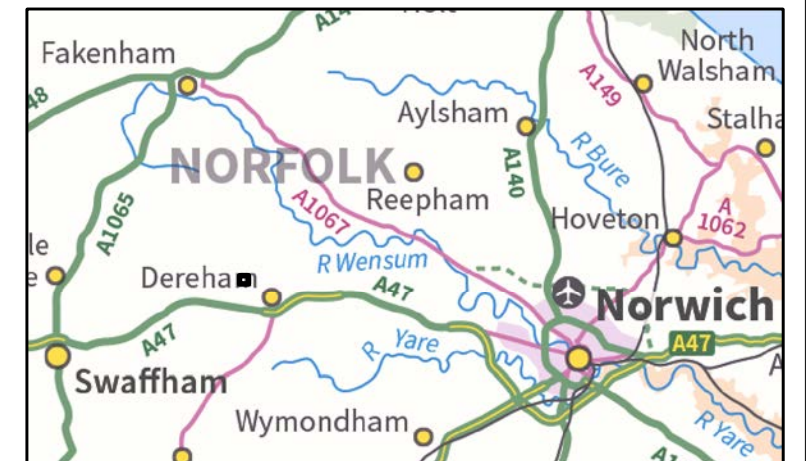
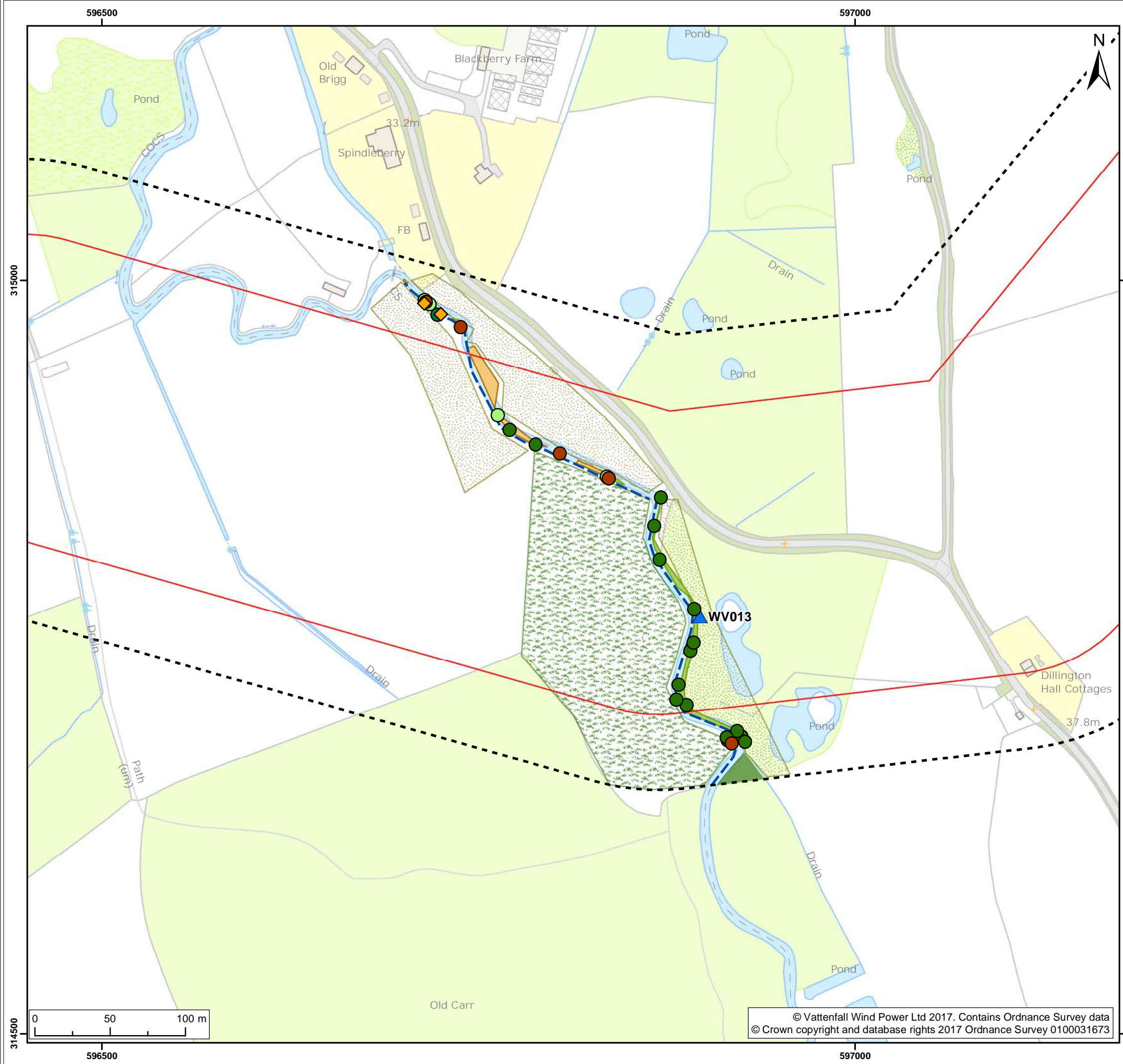
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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure
- Water vole Survey Extent
- ▲ Water vole Survey Location

Water vole Field Signs

- ◆ Burrows

Bankside Vegetation

- Reedbeds
- Scrub Area
- Fallen Tree
- Mature Tree
- Pollarded Tree
- Saplings
- Other

Adjacent Land Use

- Broadleaved Woodland
- Improved Grassland
- Rough Pasture

Project: Norfolk Vanguard	Report: Preliminary Environmental Information Report: Water Vole Survey Report
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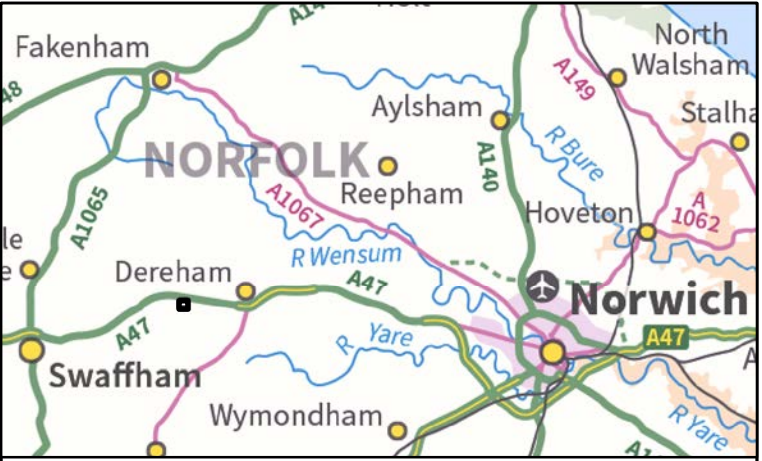
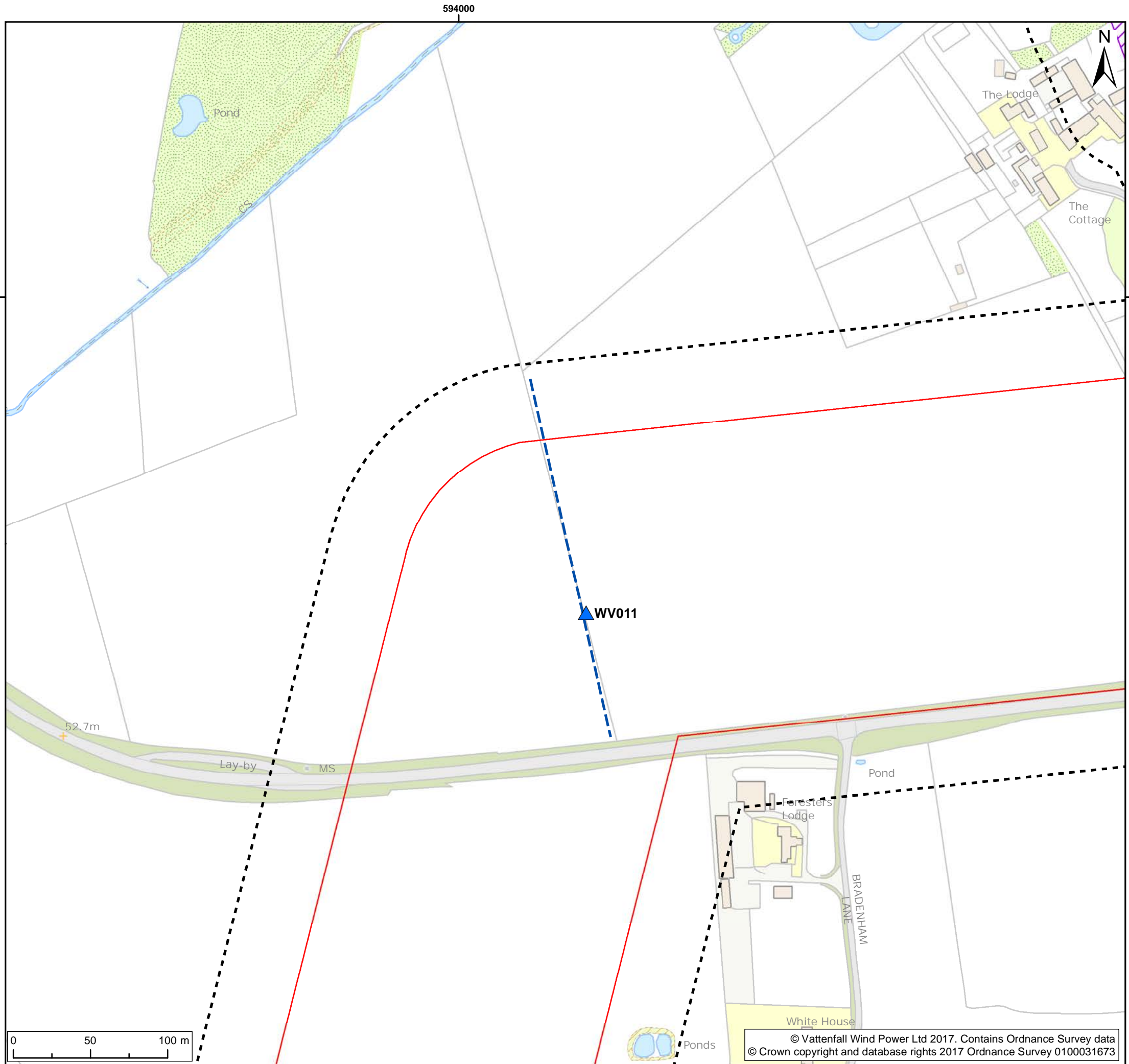
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(Page 13 of 21)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Onshore Cable Corridor
- Horizontal Directional Drilling (HDD) Zone
- Water vole Survey Extent
- Water vole Survey Location

Norfolk Vanguard Onshore Infrastructure

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:

Water Vole Survey Results
(Page 14 of 21)

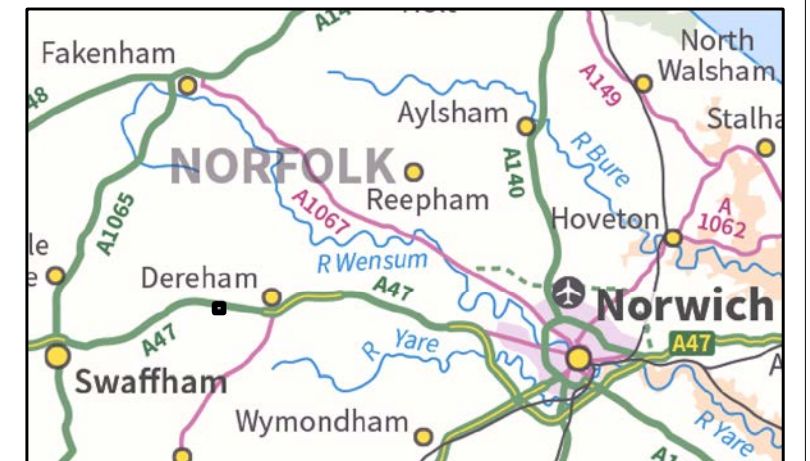
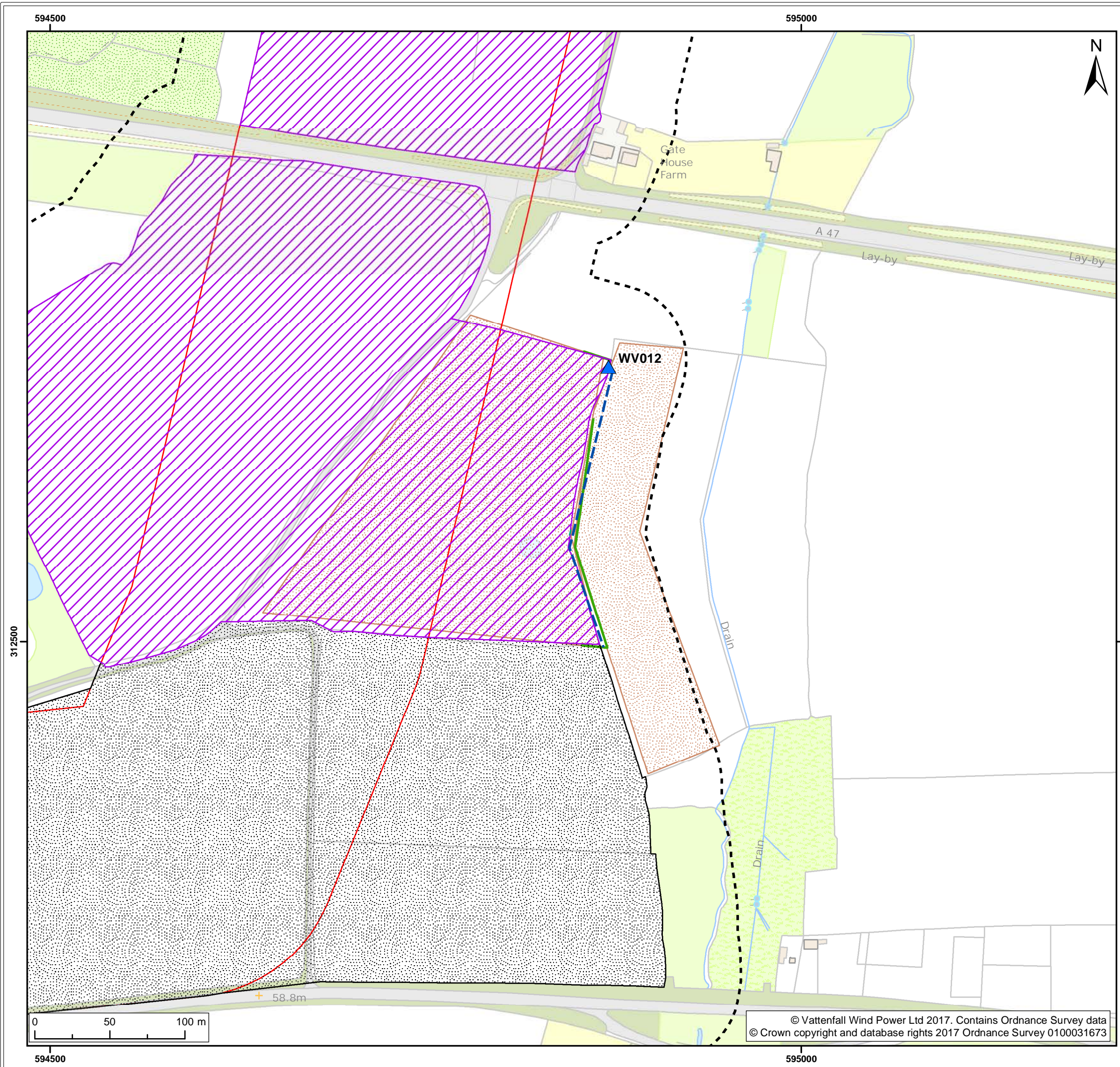
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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Horizontal Directional Drilling (HDD) Zone
- Mobilisation Zone
- Water vole Survey Extent
- ▲ Water vole Survey Location
- Hedgerow
- Adjacent Land Use**
- Tilled Land Crop
- Location of Other Features**
- Outfall

Project: Norfolk Vanguard	Report: Preliminary Environmental Information Report: Water Vole Survey Report
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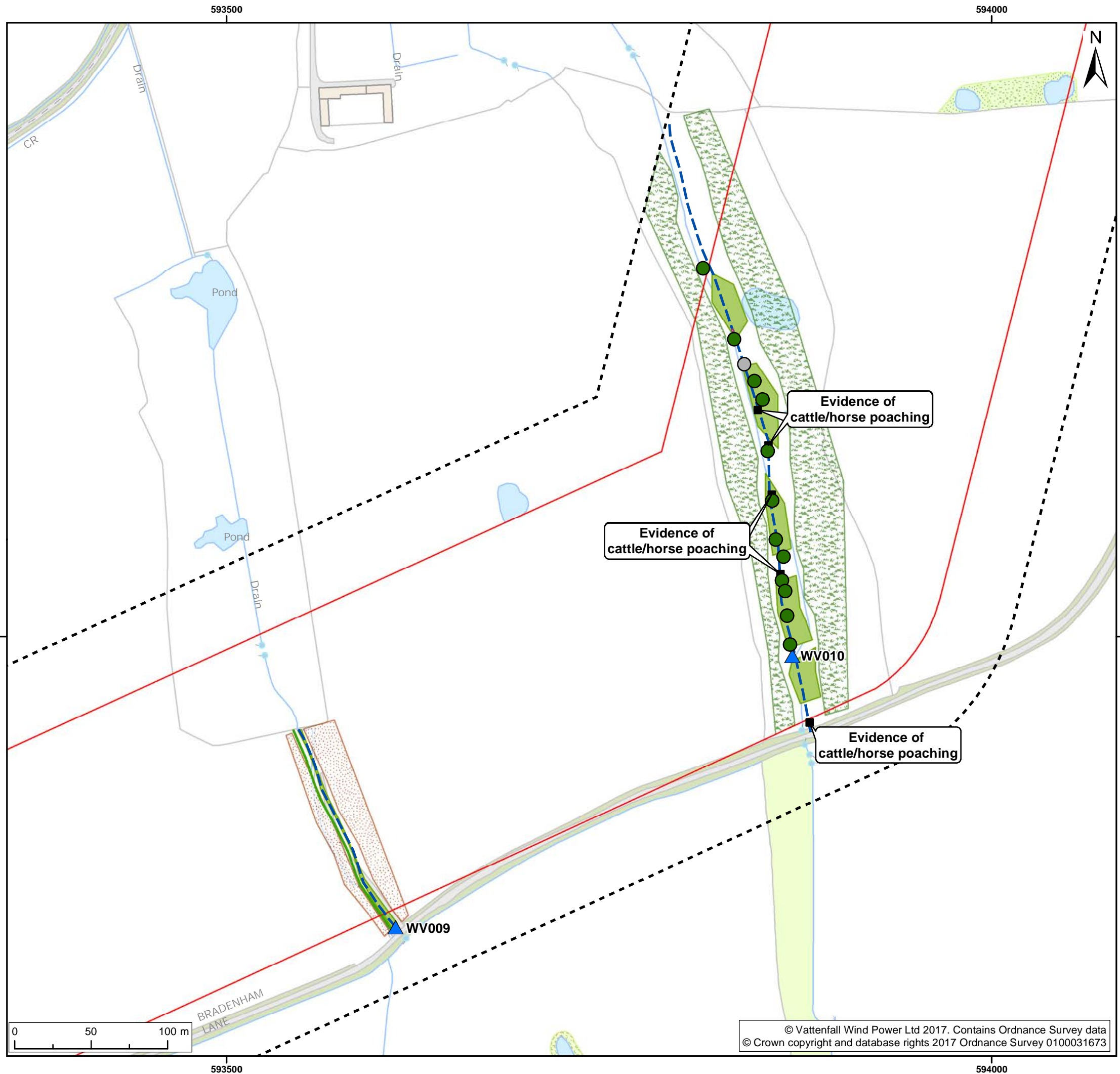
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Water Vole Survey Results
(Page 15 of 21)

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Co-ordinate system: British National Grid EPSG: 27700



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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Water vole Survey Extent
 - Water vole Survey Location
- Bankside Vegetation**
 - Scrub Area
 - Hedgerow
 - Mature Tree
 - Other
- Adjacent Land Use**
 - Improved Grassland
 - Tilled Land Crop
- Location of Other Features**
 - Culvert
 - Other Points of Interest

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:

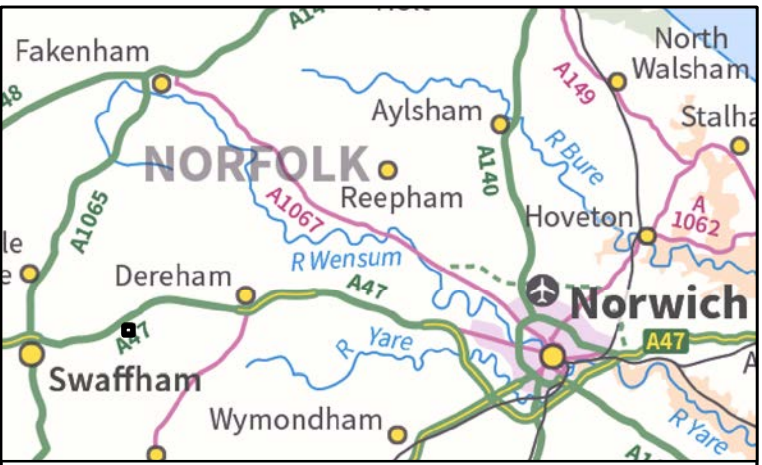
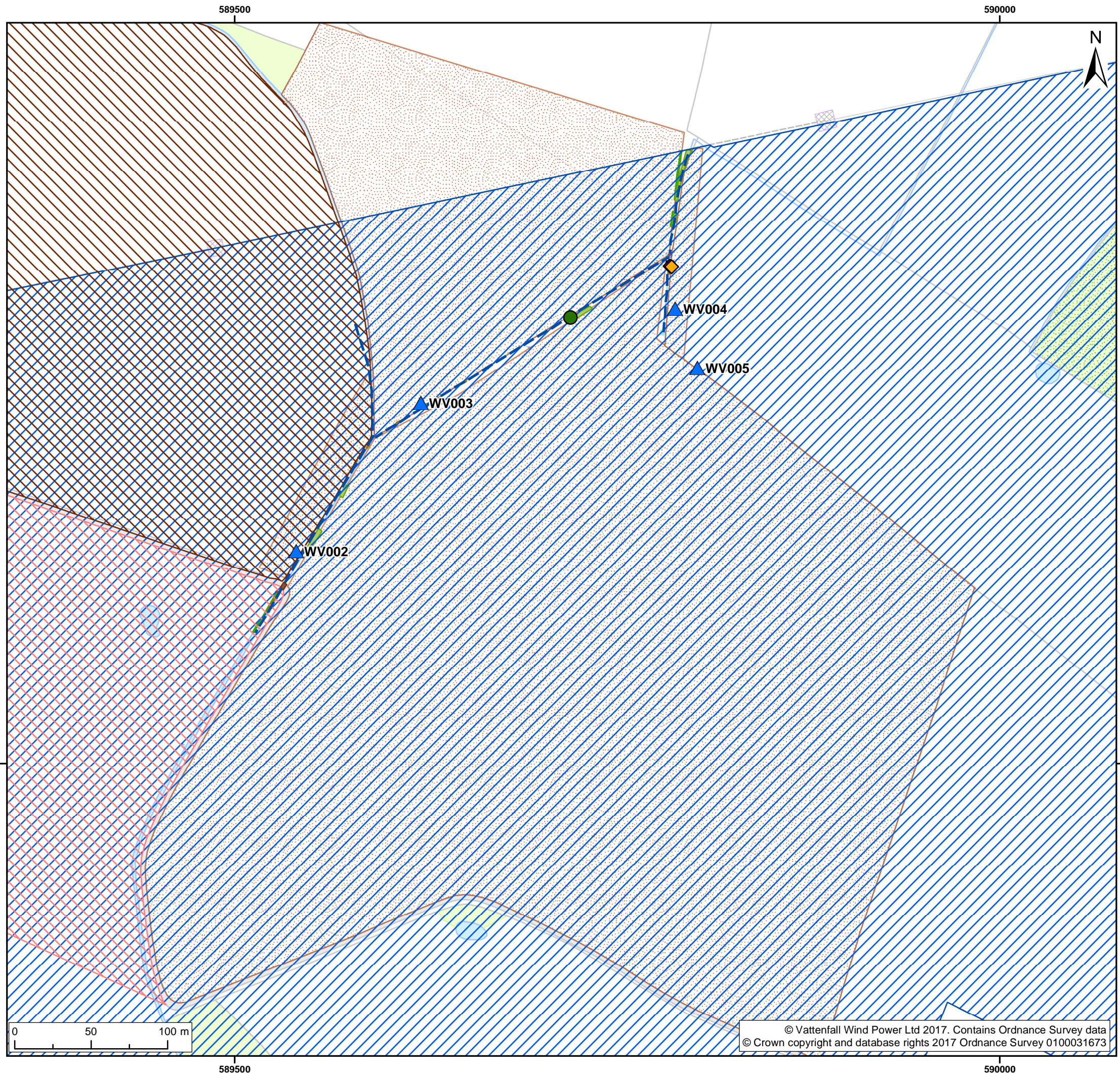
Water Vole Survey Results
(Page 16 of 21)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

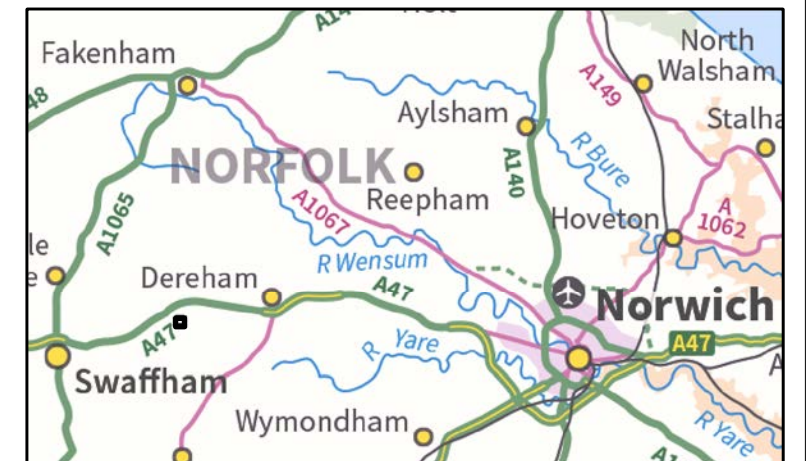
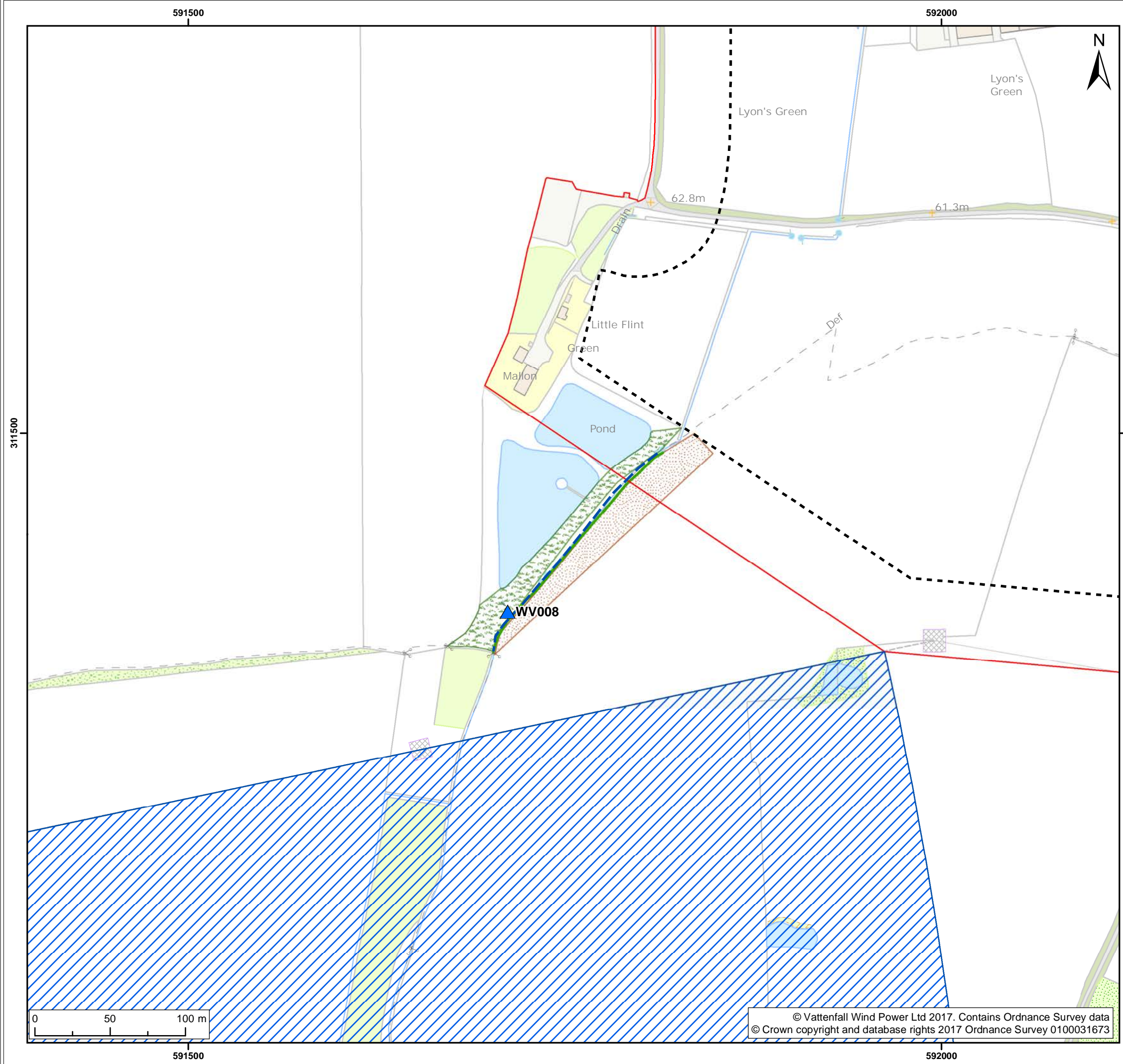
- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Project Substation Search Zone
- National Grid Substation Extension Zone
- Overhead Line Modification Zone
- Water vole Survey Extent
- ▲ Water vole Survey Location
- Water vole Field Signs**
- ◆ Burrows
- ◆ Feeding Station
- Bankside Vegetation**
- Reedbeds
- Scrub Area
- Hedgerow
- Mature Tree
- Adjacent Land Use**
- Tilled Land Crop
- Location of Other Features**
- Culvert
- Road Bridge
- Norfolk Vanguard
- Other Points of Interest

Report: Preliminary Environmental Information Report: Water Vole Survey Report

Title: Water Vole Survey Results (Page 17 of 21)

Figure: 3	Drawing No: PB4476-004-0223-003				
Revision: 01	Date: 25/07/2017	Drawn: LB	Checked: GC	Size: A3	Scale: 1:2,500

Co-ordinate system: British National Grid EPSG: 27700



- Legend:
- Survey Area
 - Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Project Substation Search Zone
 - Water vole Survey Extent
 - Water vole Survey Location
 - Hedgerow
 - Adjacent Land Use**
 - Improved Grassland
 - Tilled Land Crop

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

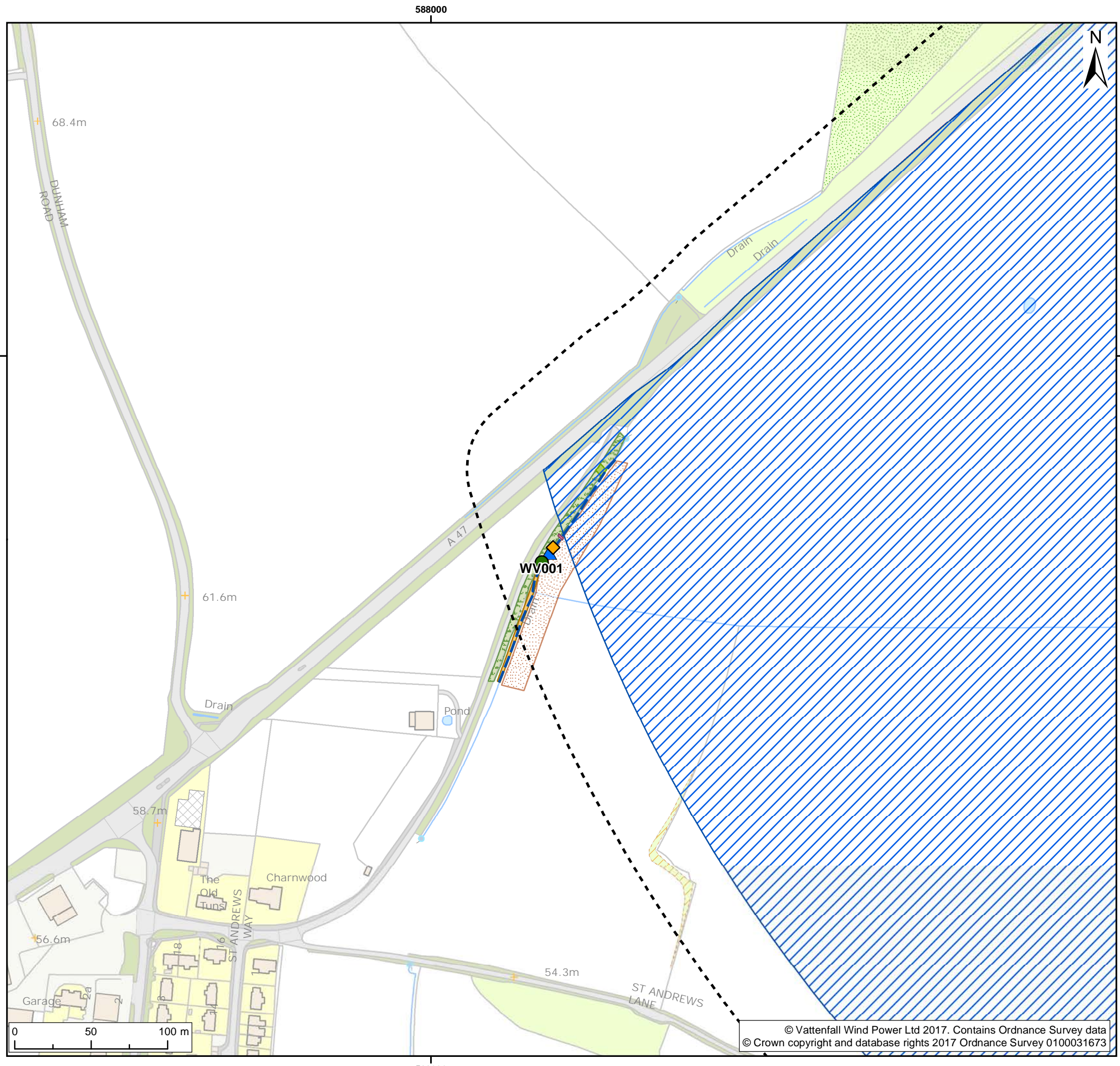
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Water Vole Survey Results
(Page 18 of 21)

Figure: 3	Drawing No: PB4476-004-0223-003				
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Co-ordinate system: British National Grid EPSG: 27700



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Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
 - Onshore Cable Corridor
 - Project Substation Search Zone
 - Water vole Survey Extent
 - Water vole Survey Location
- Water vole Field Signs**
 - Burrows
- Bankside Vegetation**
 - Reedbeds
 - Scrub Area
 - Mature Tree
- Adjacent Land Use**
 - Improved Grassland
 - Tilled Land Crop
- Location of Other Features**
 - Culvert

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

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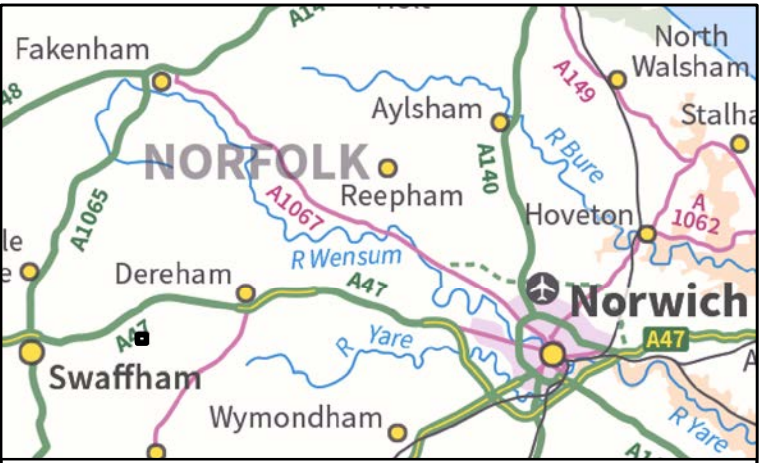
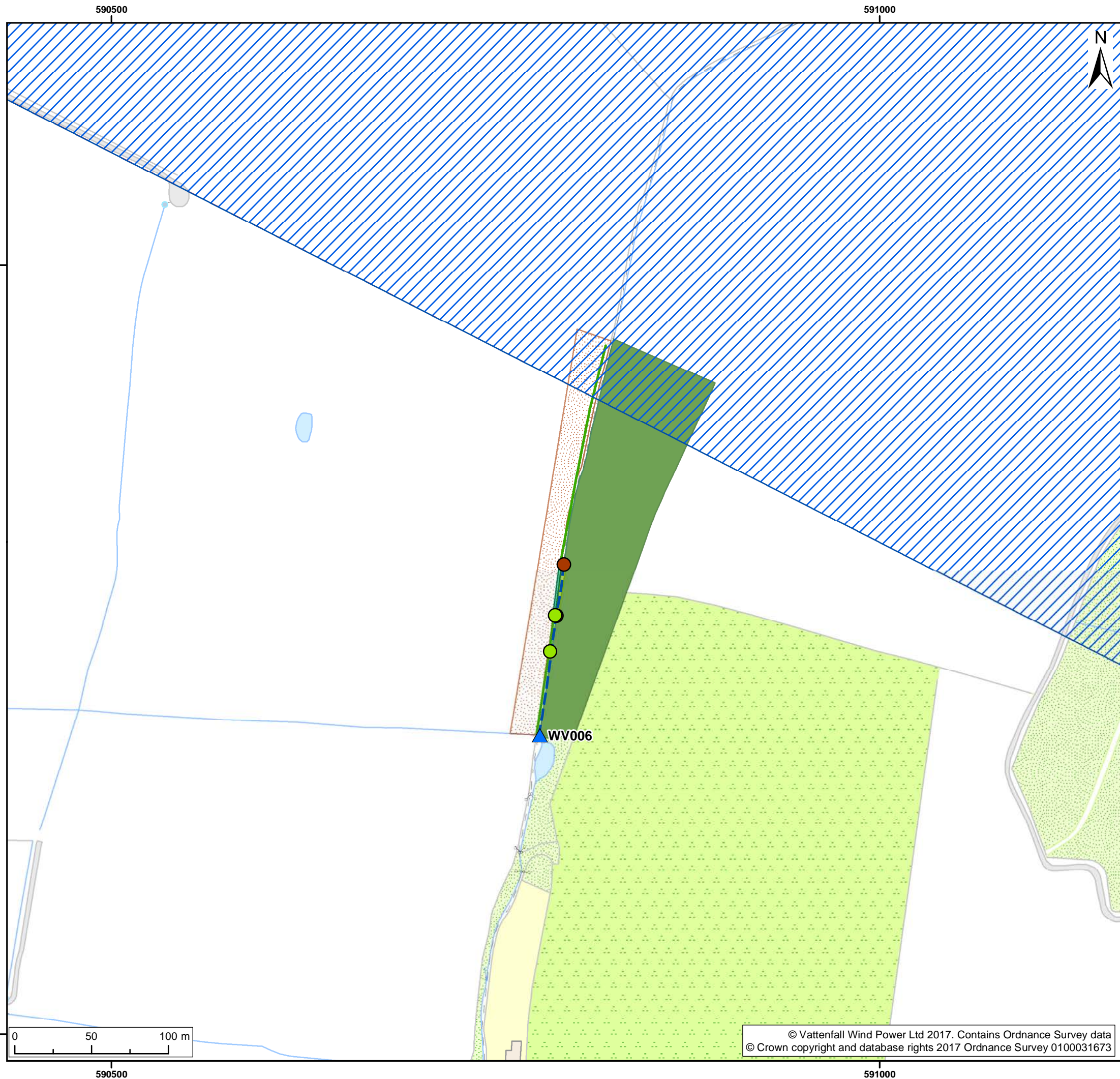
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Revision:	Date:	Drawn:	Checked:	Size:	Scale:	
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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Survey Area
- Onshore Cable Corridor
- Project Substation Search Zone
- Water vole Survey Extent
- Water vole Survey Location

Bankside Vegetation

- Overhanging Braches
- Scrub Area
- Hedgerow
- Exposed Roots
- Fallen Tree

Adjacent Land Use

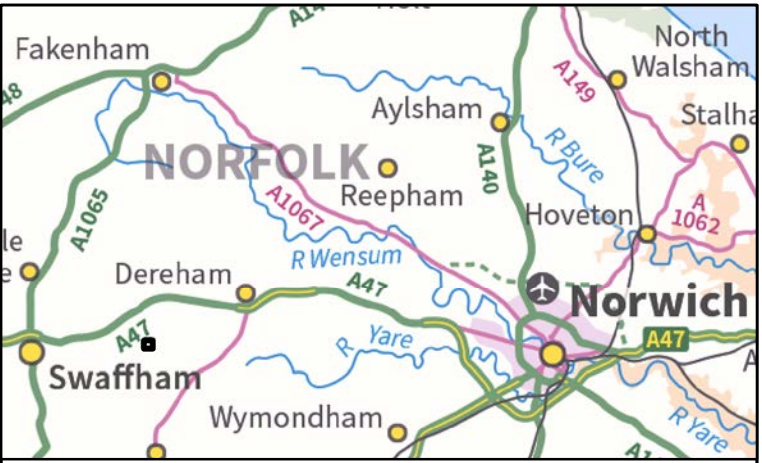
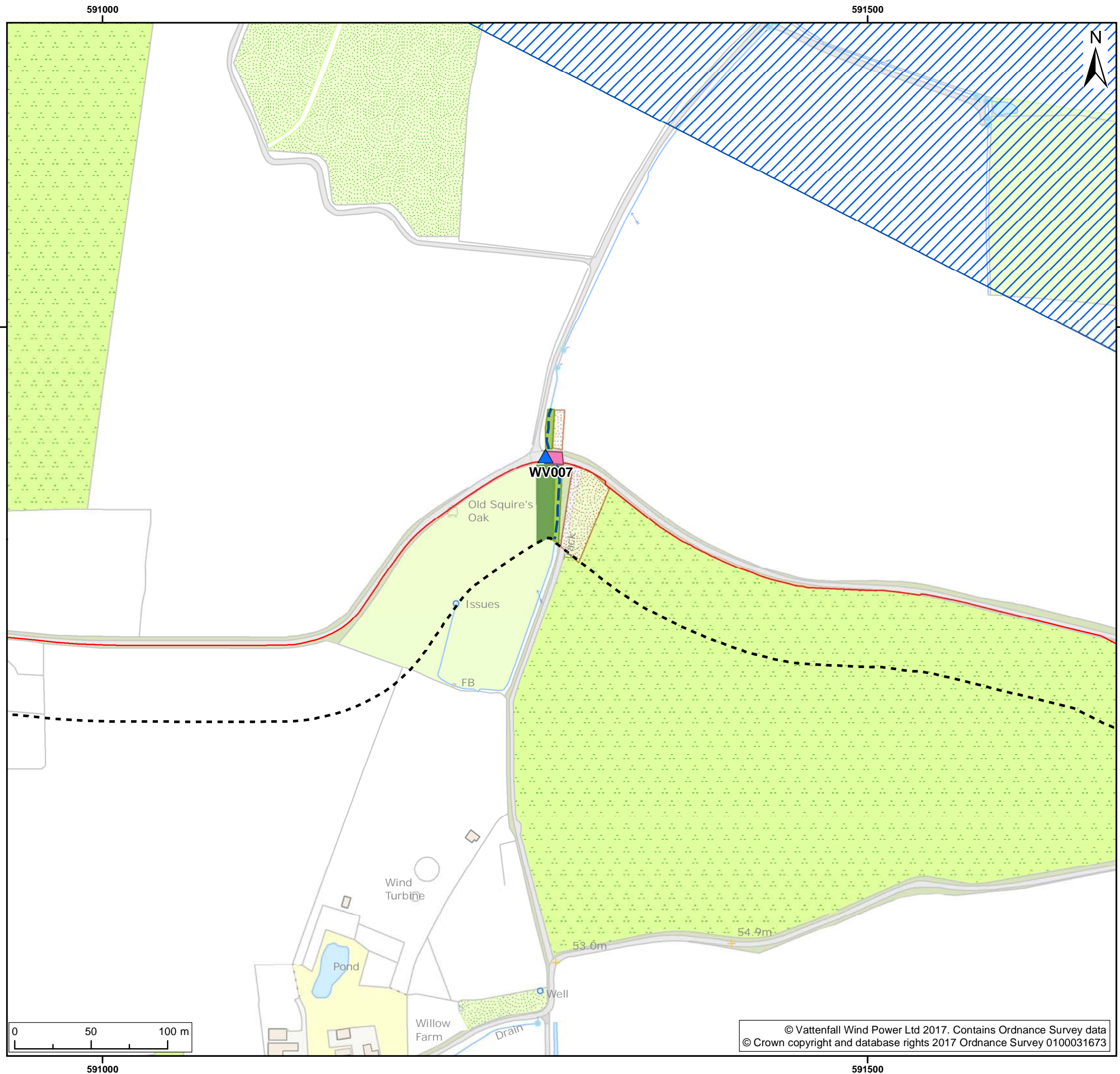
- Broadleaved Woodland
- Tilled Land Crop

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Figure:	3	Drawing No:	PB4476-004-0223-003			
Revision:	Date:	Drawn:	Checked:	Size:	Scale:	
01	25/07/2017	LB	GC	A3	1:2,500	

Co-ordinate system: British National Grid EPSG: 27700



Legend:

- Survey Area
- Norfolk Vanguard Onshore Infrastructure**
- Onshore Cable Corridor
- Project Substation Search Zone
- Water vole Survey Extent
- Water vole Survey Location
- Bankside Vegetation**
- Scrub Area
- Adjacent Land Use**
- Broadleaved Woodland
- Tilled Land Crop
- Location of Other Features**
- Culvert

Project:	Report:
Norfolk Vanguard	Preliminary Environmental Information Report: Water Vole Survey Report

Title:
Water Vole Survey Results
(Page 21 of 21)

Figure:	3	Drawing No:	PB4476-004-0223-003			
Revision:	Date:	Drawn:	Checked:	Size:	Scale:	
01	25/07/2017	LB	GC	A3	1:2,500	

Co-ordinate system: British National Grid EPSG: 27700

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22.9 Annex B: Full Water Vole Survey Results

Table 22.6 shows the full watercourse assessment results for all watercourses surveyed.

Table 22.6 Full Water Vole Survey results

Watercourse	Surveyors	Date	Weather conditions	Waterbody Type	Bank Composition	Land Use	Bankside trees	Bushes	Herbs	Submerged weed	Reeds/sedges	Tall grass	Short grass	Disturbance	Bank profile	Depth	Width	Current	Latrines	Burrows	Sightings	Footprints	Pathways	Feedings remains	Lawns	Rat field signs	Otter field signs	Mink field signs	Survey distance (km)	Additional comments
WV01	CC/CG	17/05/17	Wet, humid warm (18C)	Ditch, running water	Earth	Arable crop, upland grass	Rare	Rare	Occasional	Occasional	Rare	Frequent	Dominant		Steep > 45o	< 0.5m	1-2m	Fast	0	1	0	0	0	0	0	0	0	0		Burrow in bank, no other field sings
WV02	CC/CG	17/05/17	Wet, humid warm (18C)	Ditch	Earth, silt, sand	Arable crop	Rare	Occasional	Occasional	Rare	Rare	Abundant	Dominant		Steep > 45o	< 0.5m	1-2m	Slow	0	0	0	0	0	0	0	0	0	0		
WV03	CC/CG	17/05/17	Wet, humid warm (18C)	Ditch	Earth, silt, sand	Arable crop	Rare	Occasional	Occasional	Rare	Rare	Abundant	Dominant		Steep > 45o	< 0.5m	1-2m	Slow	0	0	0	0	0	0	0	0	0	0		
WV04	CC/CG	17/05/17	Wet, humid warm (18C)	Ditch	Earth, silt	Arable crop	Occasional	Occasional	Rare	Occasional	Rare	Frequent	Frequent		Steep > 45o	< 0.5m	1-2m	Fast	0	0	0	0	0	0	0	3	0	0		Ditch mostly overgrown, most areas inaccessible. Runs observed in bank side, too large for water vole; rat feeding remains also observed
WV05	CC/CG	17/05/17	Dry, fine warm (22C)	Ditch	Earth, silt	Arable crop	Occasional	Occasional	Rare	Occasional	Rare	Frequent	Frequent		Steep > 45o	< 0.5m	1-2m	Fast	0	1	0	0	0	0	0	0	0	0		
WV06	CC/CG	17/05/17	Dry, fine warm (22C)	Running water	Earth, silt, sand, gravel	Arable crop, mixed broadleaf woodland	Dominant	Occasional	Rare	Rare	Rare	Rare			Steep > 45o	< 0.5m	1-2m	Fast	0	0	0	0	0	0	0	0	0	0		Ditch running through woodland. Mostly overgrown, overhanging branches and dense scrub. Mostly inaccessible. Low water levels (c5cm), rocky banks and substrate, limited burrowing opportunity
WV07	CC/CG	17/05/17	Dry, fine warm (22C)	Running water	Earth, silt, sand, gravel	Arable crop, mixed broadleaf woodland	Dominant	Rare	Rare	Rare	Rare	Rare	Rare		Vertical/un dercut	< 0.5m	1-2m	Fast												Mostly dry with sections of standing water. Mostly inaccessible due to dense scrub along banks, no survey undertaken.
WV08	CC/CG	17/05/17	Dry, fine warm (22C)	Ditch	Earth, silt	Arable crop	Rare	Dominant	Frequent	Occasional	Occasional	Rare	Abundant		Steep > 45o	< 0.5m	1-2m	Fast												Dry in patches on both sides of the road culvert, dense vegetation, access difficult, no survey undertaken.
WV09	CC/CG	17/05/17	Dry, fine warm (22C)	Ditch, running water	Earth, silt, sand, gravel	Arable crop	Dominant	Abundant	Frequent	Rare	Rare	Abundant	Abundant		Steep > 45o	< 0.5m	1-2m	Fast												Dry ditch, no survey undertaken.

Watercourse	Surveyors	Date	Weather conditions	Waterbody Type	Bank Composition	Land Use	Bankside trees	Bushes	Herbs	Submerged weed	Reeds/sedges	Tall grass	Short grass	Disturbance	Bank profile	Depth	Width	Current	Latrines	Burrows	Sightings	Footprints	Pathways	Feedings remains	Lawns	Rat field signs	Otter field signs	Mink field signs	Survey distance (km)	Additional comments	
WV10	CC/CG	17/05/17	Dry, fine warm (22C)	Ditch, running water	Earth, silt, poached	Arable crop, upland grass	Abundant	Dominant	Frequent	Rare	Rare	Frequent	Abundant		Shallow < 450	< 0.5m	1-2m	Fast	0	0	0	0	0	0	0	0	0	0			
WV11	GC/TC	17/05/2017	Damp, humid warm (20C)	Ditch, running water	Earth	Upland grass	Rare	Rare	Rare	Frequent	Rare	Abundant	Dominant		Steep > 450	< 0.5m	1-2m	Fast												Ditch now fully dry and not suitable for WV. No detailed survey undertaken.	
WV12	GC/TC	17/05/2017	Damp, humid warm (20C)	Ditch	Earth	Arable crop	Occasional	Occasional	Occasional	Frequent	Rare	Abundant	Abundant	Maintained ditch. No evidence of maintenance in last 5 years	Steep > 450	< 0.5m	1-2m	Static	0	0	0	0	0	0	0	0	0	0		Water level very low at time of survey (approx less than 5cm). Not all areas accessible for survey due to dense vegetation	
WV13	CC/TC	20/06/2017	Damp, humid warm (20C)	Running water	Earth	Mixed broadleaf woodland, cattle/grazing	Abundant	Frequent	Frequent	Rare	Rare	Occasional	Occasional	Watercourse adjacent to area of cattle grazing. No evidence of poaching.	Steep > 450	1-2m	2-5m	Slow	0	0	1	0	0	0	0	0	0	0		No field signs observed, horse grazing in adjacent field, vegetation dense in places making watercourse difficult to access. 16/05/17 - water vole observed during newt survey at pond -157 near to watercourse.	
WV14	GC/TC	17/05/2017	Damp, humid warm (20C)	Running water	Earth	Arable crop, cattle/grazing, conifer wood	Abundant	Rare	Abundant	Rare	Frequent	Frequent	Rare	Stock-proof fence between pastoral field and watercourse banks. No disturbance.	Shallow < 450	0.5-1m	1-2m	Slow	0	0	0	0	0	1	0	0	0	0		Dense woodland cover adjacent to watercourse. Some sections not fully accessible, but majority of watercourse is accessible	
WV15	GC/TC	17/05/2017	Damp, humid warm (20C)	Running water	Earth	Permanent/temporary grass, cattle/grazing	Rare	Rare	Occasional	Occasional	Frequent	Frequent	Abundant	Cattle poaching on left hand bank	Steep > 450	0.5-1m	1-2m	Slow	2	3	0	0	1	2	0	0	1	0		Heavy rain on evening before survey may affect field signs	
WV32	GC/TC	17/05/2017	Damp, humid warm (20C)	Running water	Earth	Permanent/temporary grass, cattle/grazing	Occasional	Occasional	Frequent	Frequent	Abundant	Abundant	Abundant	Evidence of cattle poaching	Shallow < 450	2-5m	30m	Slow	15	5	0	1	0	14	0	2	0	0		Survey conducted from right hand bank	
WV16				Running water	Earth	Permanent/temporary grass, arable crop, mixed broadleaf woodland	Occasional	Rare	Frequent	Frequent	Occasional	Frequent	Occasional	Channel artificially straightened. Not within the last 5 years.	Steep > 450	0.5-1m	2-5m	Rapid													Not surveyed due to landowner restriction.




Watercourse	Surveyors	Date	Weather conditions	Waterbody Type	Bank Composition	Land Use	Bankside trees	Bushes	Herbs	Submerged weed	Reeds/sedges	Tall grass	Short grass	Disturbance	Bank profile	Depth	Width	Current	Latrines	Burrows	Sightings	Footprints	Pathways	Feedings remains	Lawns	Rat field signs	Otter field signs	Mink field signs	Survey distance (km)	Additional comments
WV17	GC/TC	18/05/2017	Dry, clear warm (24C)	Running water	Earth	Mixed broadleaf woodland	Abundant	Occasional	Abundant	Occasional	Rare	Frequent	Rare	Ditch managed, but no evidence of recent excavation. Subject to arable runoff.	Steep > 450	< 0.5m	1-2m	Rapid												Drain is completely dry. No survey undertaken
WV18	GC/TC	18/05/2017	Dry, clear warm (24C)	Ditch	Earth, silt, sand, gravel	Arable crop	Dominant	Frequent	Abundant	Rare	Rare	Abundant	Abundant		Steep > 450	< 0.5m	2-5m	Fast												Ditch is completely dry. No survey undertaken
WV19	GC/TC	18/05/2017	Dry, clear warm (24C)	Ditch	Earth, silt, sand	Arable crop, mixed broadleaf woodland	Dominant	Occasional	Frequent	Rare	Rare	Frequent	Frequent	No	Steep > 450	< 0.5m	2-5m	Fast												Ditch not present, small pond only. No surveys undertaken.
WV20	CC/CoC	01/06/2017	Dry, clear, warm (20C)	Running water	Earth, silt, sand	Upland grass	Dominant	Dominant	Dominant	Rare	Occasional	Dominant	Dominant	Possible water abstraction in upper reaches	Shallow < 450	0.5-1m	5-10m	Fast	0	0	0	0	0	0	0	2	0	0		Majority of watercourse surveyed from within, however large sections impenetrable due to dense vegetation.
WV21	CC/CoC	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth, silt, sand	Upland grass, mixed broadleaf woodland	Dominant	Rare	Frequent	Rare	Rare	Rare	Frequent		Shallow < 450	< 0.5m	2-5m	Static												Dry ditch, no survey
WV22	CC/CoC	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth	Mixed broadleaf woodland, cattle/grazing	Abundant	Rare	Occasional	Occasional	Abundant	Frequent	Frequent		Steep > 450	0.5-1m	2-5m	Sluggish	0	1	0	0	2	0	0	0	1	0		Surveyed from RHB only, water too deep and substrate too silty to access. Cows present in field on opposite bank. Runs spotted in vegetation, alongside areas of flattened grass at water's edge. Potentially caused by swans/geese observed in the area
WV33	CC/TC	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth	Cattle/grazing	Rare	Rare	Frequent	Rare	Frequent	Frequent	Frequent	Extensive poaching	Steep > 450	< 0.5m	1-2m	Static												Ditches west of River Bure, not suitable for water vole. Cattle present, evidence of poaching, poor water quality, lack of in channel vegetation and minimal bank side vegetation diversity. No survey undertaken.
WV23	CC/CoC	01/06/2017	Dry, clear, warm (20C)	Ditch, running water	Earth	Permanent/temporary grass, mixed broadleaf woodland	Abundant	Rare	Frequent	Occasional	Frequent	Frequent	Occasional	No evidence of recent drain maintenance	Steep > 450	0.5-1m	1-2m	Slow	0	0	0	0	0	0	0	0	0	0		Majority of watercourse surveyed from banks, too steep to access in places. No WV evidence observed, water quality is poor.

Watercourse	Surveyors	Date	Weather conditions	Waterbody Type	Bank Composition	Land Use	Bankside trees	Bushes	Herbs	Submerged weed	Reeds/sedges	Tall grass	Short grass	Disturbance	Bank profile	Depth	Width	Current	Latrines	Burrows	Sightings	Footprints	Pathways	Feedings remains	Lawns	Rat field signs	Otter field signs	Mink field signs	Survey distance (km)	Additional comments
WV24	CC/CoC	01/06/2017	Dry, clear, warm (20C)	Running water	Earth	Permanent/temporary grass, mixed broadleaf woodland, cattle/grazing	Frequent	Occasional	Occasional	Occasional	Abundant	Frequent	Frequent	Artificial, but no evidence of recent maintenance	Steep > 450	1-2m	2-5m	Rapid	0	0	0	0	0	0	0	0	0	0	0	As previous, surveyed from bank as too steep to access, water also too deep for waders. Upper reaches not surveyed due to dense vegetation.
WV25				Ditch, running water	Earth	Arable crop	Occasional	Rare	Occasional	Occasional	Rare	Dominant	Abundant	Artificial, but no evidence of recent maintenance	Steep > 450	< 0.5m	1m	Rapid												Not surveyed due to landowner restriction
WV26	JD/MW	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth, silt, sand	Permanent/temporary grass	Rare	Rare	Abundant	Frequent	Abundant	Abundant	Dominant	Evidence of recent clearance of channel by bucket	Steep > 450	0.5-1m	5-10m	Slow	0	0	0	0	0	0	0	0	0	0	0	This ditch was mostly dry, with water in areas where scraping of channel has been undertaken (assumed for drainage purposes). No evidence of water vole noted. NB: actual watercourse is located north of the marker shown on the survey plan.
WV27	JD/MW	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth, silt, sand	Arable crop	Rare	Dominant	Abundant	Occasional	Dominant	Frequent	Abundant	Evidence of recent clearance of channel by bucket	Steep > 450	< 0.5m	2-5m	Slow	0	0	0	0	0	0	0	0	0	0	0	Canal too deep to access. Survey undertaken from either side of watercourse. No evidence of water voles. Signs of recent scraping on bank edges. Bank substrate appears mostly too compacted to allow for WV burrowing.
WV28	JD/MW	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth, silt	Mixed broadleaf woodland, arable crop	Dominant	Abundant	Frequent	Frequent	Abundant	Frequent	Rare		Steep > 450	< 0.5m	2-5m	Static												Ditch fully dry and not suitable for WV. Water body where marker shows on pdf map is not suitable for WV. No detailed survey undertaken.
WV29	JD/MW	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth, silt, sand	Arable crop	Rare	Occasional	Frequent	Abundant	Abundant	Occasional	Dominant		Steep > 450	< 0.5m	2-5m	Static												Water body fully dry and not suitable for WV. No detailed survey undertaken.
WV30	JD/MW	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth, silt	Arable crop	Rare	Rare	Occasional	Rare	Rare	Abundant	Abundant		Steep > 450	< 0.5m	1-2m	Static	0	0	0	0	0	0	0	0	0	0	0	Unable to enter water body due to deep silts. Survey undertaken from both banks. No evidence of WV noted. Access west of point reference for site is difficult due to dense vegetation.
WV31	JD/MW	01/06/2017	Dry, clear, warm (20C)	Ditch	Earth, silt, sand	Arable crop, cattle/grazing	Rare	Rare	Occasional	Occasional	Occasional	Frequent	Dominant		Steep > 450	< 0.5m	1-2m	Static												Ditch fully dry and not suitable for WV. No detailed survey undertaken.

22.10 Annex C: Plates

Table 22.7 contains the plates recorded for each watercourse surveyed.




Table 22.7 Population density

Water-course	NGR of plate	Plate
WV01	588079, 310374	
WV02	-	-
WV03	-	-
WV04	-	-
WV05	589784, 310825 589785, 310824	
WV06	-	-
WV07	-	-
WV08	-	-
WV09	-	-
WV10	-	-
WV13	-	-
WV14	603573, 316440	

Water-course	NGR of plate	Plate
WV15	603942, 317524 603975, 317532 604017, 317539	
WV32	604225, 317521 to 604151, 317468	

Water-course	NGR of plate	Plate		
				
				
				
				
				
				

Water-course	NGR of plate	Plate		
				
				
				
				
				
				

Water-course	NGR of plate	Plate
		
WV20	-	-
WV21	612529, 324322	
WV22	619934, 328810 619933, 328809 619921, 328796	
WV33	-	-
WV23	-	-
WV24	-	-
WV25	-	-
WV26	-	-
WV27	-	-
WV28	-	-
WV29	-	-
WV30	-	-
WV31	-	-

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